HOW TO RAISE CHICKS

By
PRINCE T. WOODS, M.D.

For success the rearing of chicks should begin with the parent stock.

Breed for health.

Manage for Comfort.

There is no prettier picture of spring time than a proud, well set up, thoroughbred mother hen surrounded by a fine flock of sturdy, healthy, downy chicks that are well cared for. (Photo by Dr. Woods.)

HOW TO RAISE CHICKS

INCLUDING REVISION OF FACTS ABOUT WHITE DIARRHOEA

A Practical Book That Tells How to Select and Manage Breeding Fowls, What You Want to Know About Foods and Feeding, How to Get Hatchable Eggs, How to Hatch with Hens or Incubators, How to Brood and Raise Chicks, What White Diarrhoea is and How to Prevent It.

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FOREWORD

RAISING the chicks has been named as the most difficult "poultry problem" and some poultrymen say that "everything else is easy." If one begins right, with well born chicks, chick rearing ought not to prove so very difficult. What is meant by beginning right?

For success the rearing of chicks should begin with the parent stock. You must have good healthy hatchable eggs in order to get good livable chicks. You can't get good healthy hatchable eggs unless you breed for health and manage for comfort. Select your breeding stock with great care to get the maximum of constitutional vigor; so manage and care for them that they will be comfortable, contented, and happy, and you will find them productive and possessing abundant vigor, vitality and health. These good and necessary qualities will prove an invaluable hereditary asset when the time comes for hatching eggs and rearing chicks.

In this book considerable space has been given to selection and mating of breeding stock, to care and management of breeders, to foods and the relation of fowls to food. I believe that a better understanding of these subjects will make it easier to solve the "problem" of how to raise chicks. It does not pay the farmer to sow poor seed. It will not pay the poultryman to produce poor seed eggs and weakling chicks by breeding, hatching and rearing from stock birds that are lacking in constitutional vigor. If you want strong sturdy chicks, full of health, vigor and vitality—the power to live—there is one safe and sure way to get them and that is to begin right with sound, well selected stock and breed for health.

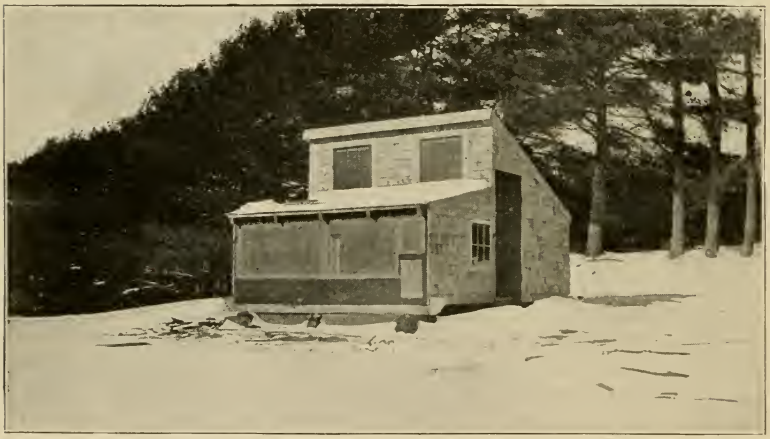
Herein also will be found chapters on natural and artificial incubation and brooding, including the preparation of chick foods and care, feeding and management of chicks during growth,—all are presented with the object of helping the reader to success in chick rearing. My earlier booklet "Facts About White Diarrhoea" has been revised and largely rewritten and incorporated as a part of this book. The formula is given for a remedy which has been thoroughly tried for four years under a wide range of climates and conditions in the

prevention and treatment of white diarrhoea and which has proved successful and satisfactory in the majority of cases reported.

It is hoped, friend Reader, that this book will help you to greater success in chick rearing, to more and better chicks and to greater comfort for the chicks themselves,—if it interests you and you profit by the advice herein given the book will be well worth while.

Prince T. Woods, M. D.

Silver Lake, Mass., January 23, 1912.



Dr. Woods' open-front, open-air poultry house as used by Wozelma Farms Producing Company in association with American Poultry Journal's Experimental Plant, Silver Lake, Mass. This is a colony house for breeders, portable type, 10 ft. wide by 16 ft. deep and will accommodate a flock of fifty fowls. (Photo by John E. Zeller.)

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View of a successful New England market poultry plant, Fostercroft Poultry Yards, Charles E. Foster, Danvers, Mass., proprietor. This plant is devoted exclusively to the production of first quality broilers, roasters, table fowl and fancy fresh eggs for a select "North Shore" trade. Fancy prices are obtained for a high class product. Here the growing chickens have unrestricted range on land well turfed with grass and clover. View shows a part of the range for chicks.

CHAPTER 1.

Selecting and Mating Breeding Stock

TO BE SUCCESSFUL in breeding poultry, you must start right, get a lasting, solid foundation. Breed for health of future generations of fowls by beginning now to select your breeding stock for physical soundness, vitality, constitutional vigor—in a word—health. Keep them healthy by good housing, good food, good care and good management. Get common sense into your poultry keeping.

Breed for health if you wish to have and produce healthy chicks. Feed, house and manage for health if you would keep your stock healthy. Don't sow poor seed. You would not expect a good crop from poor seed corn. Remember that the hatching eggs are your poultry seed. You cannot get good seed eggs from stock that does not possess health—constitutional vigor. Without good seed eggs you cannot get good chicks.

The breeding stock is the foundation of your poultry business, the life of your undertaking and the source of the seed eggs from which you intend to produce chickens. You must have abundant constitutional vigor in the breeding stock to get vitality in the chicks. What is vitality? Vitality is the possession of vital force. The power to live and thrive.

Unless the breeding birds are sound and in the best possible condition for the reproduction of their kind, satisfactory results in hatchable eggs and sturdy chicks cannot be obtained. Condition has been said to be more than half the battle in winning prizes in the show room. Physical condition is the whole thing in the breeding pen and without this foundation to build on your strain will be without value. Eggs from healthy, sound, well-fed parent stock will hatch strong, sturdy chicks, full of vitality, often even under what are considered quite unfavorable conditions. Chicks from such stock are not subject to chicken ailments and do not become victims of "white diarrhoea." As one breeder said, "get the right sort of chicks and it will take a lot of abuse to kill 'em; they are born to live."

Eggs from breeding stock that is out of condition, either from

abuse of inbreeding, unsanitary surroundings, improper food, sickness or other causes, will never produce chicks that are worth the trouble it takes to hatch and rear them. When chicks die in the shell, are slow to hatch, or die off in large numbers within ten days after hatching, don't lay the trouble all to faulty incubation; investigate the breeding stock. With good eggs, incubation may be, and often is, at fault; but in very many cases the eggs are not good and the breeding stock is all wrong. Oftentimes you will get an exceptional hatch only to find that the chicks die off like sick flies in the first ten days. Here again, investigate the breeding stock; errors of incubation may have been the cause, but it is quite possible that the exceptional hatch was simply an indication that nature was trying to provide against extinction, because of lack of constitutional vigor in the breeding stock. Abuse sometimes results in remarkable "provisional fecundity," though the efforts of nature may be futile.

To investigate the breeding stock, go over the birds carefully to learn their physical condition. Select and mate them up again as at the beginning of the season. Look carefully into the housing, care and feeding of the breeding stock. You will find in many cases that the cause lies with the stock or their management. When you find the cause you can prevent further trouble by avoiding or removing the cause. Breed for health if you wish to produce and have healthy chicks. Feed, house and manage for health if you would keep your stock healthy. Remember the three "C's" essential to health and success with your flock—cleanliness, comfort and contentment. Cleanliness of food, houses, yards and furnishings. Comfort and contentment for the flock because of good care, good food, good housing and good management.

The Male Bird.—In many particulars what is essential in a breeding male is equally necessary in the breeding female, for convenience we will consider these under this head and simply refer to them when treating of the section of female breeders.

From the breeding standpoint the male is half of the pen; i. e., you depend upon him to fertilize the eggs laid by all the hens with which he is mated. For this reason, whatever else you do, you cannot afford to be careless or indifferent in your selection of the cock or cockerel which is to head the pen. He should be as near perfection in constitutional vigor, physical soundness, health, as it is possible for you to judge. He must be carefully watched to see that he is capable of performing well the duty to which he is assigned. The eggs from his pen should be incubated and tested at home before any are sold for hatching. Failure to observe these rules is fatal to good results.

The male should be a good standard breeding specimen of the variety which he represents, but above all else he should be physically sound. Inferior or unhealthy male birds have no place whatever in the breeding pen. Never breed from a bird that has had or has apparently recovered from any serious illness. It is always difficult to determine whether a cure is complete or not, and whether there remains taint or chronic trouble.

In selecting a male bird to head the breeding pen, choose one that is well matured; i. e., full grown and well filled out in size and fully furnished as to plumage. He should be of good size for the variety, but not overlarge for the females. He should be broad-backed, deep, full-breasted, with stout, good-sized legs, thighs well set apart and no tendency to a "knock-kneed" appearance at the hock joints; good carriage and symmetry, well-formed comb and wattles, neither too large nor too small and of a bright, healthy red; keen, sharp, bright eyes, a bit full and somewhat egg-shaped as to curve of eye lens when viewed from the rear; a well-shaped, stout beak of medium length, the whole head being well proportioned to the body and carried in a manner that gives the bird an alert, active, aggressive, businesslike appearance. He should be in the best possible condition physically and capable of taking his place as head of the pen and holding it against all comers. His plumage should be bright and well kept, legs and feet clean and free from swellings and scale mites.

Do not breed from any male or female, no matter how good or how perfect it may be in standard points, that shows the following faults which indicate unsoundness: Crow-head and hawk bill, crooked breast bone, roach-back or other deformity, knock knees, small, thin shanks for the variety; badly rumpled plumage, lacking in luster and which seems to be inclined to turn the wrong way; shortness of breath on running or jumping or after service; pale face and comb or discolored face and comb; much rattling in throat; foul discharge from the vent; blue-green or grass-green stain from droppings on plumage below vent; vertigo (dizziness); violent and frequent shaking of head with a tendency to step backward or to one side; staggering or wabbling gait; jerking walk like "string halt"; paralysis of any kind; bunches of foreign growths on any part of body; emaciated, debilitated condition; leg weakness; foot, hock or wing ulcers, swellings or abscesses; deformities of any kind; or any other symptom of physical unsoundness or disease.

Examine the mouth and throat carefully and discard the bird if the mucous membrane is unhealthy. Simple canker may be cured, but if it is obstinate, and will not yield to simple remedies, better choose another bird that is not so affected. Note carefully the condi-

tion of the legs. If they feel hot and dry, look closely for other symptoms of disease. Hot, dry or withered feet and legs means that there is something wrong with the bird. It is a sure sign. Scaly leg is a parasitic disease and does not necessarily disqualify the bird for breeding. It is easily cured, and should be before the bird is placed in the breeding yard.

Don't breed a male lacking in constitutional vigor. Breeding from an unsound male is sure to result in trouble and disappointment later; either he will not fertilize the eggs at all or you will get weak germs and weak chicks. Weak germs are often the cause of chicks dying at all stages of development during incubation and for several days after hatching. There is also always the possibility and probability that chicks from such source, if they live, will inherit some tendency to disease which will result in losses, direct or indirect, by continuance of the inherited taint from an unsound body. It often takes years of careful breeding and management to uproot evil of that sort. Breed healthy males only and keep them healthy.

Care of the Male Bird.—Test the male by "flirting" him with other males in the presence of females. If he is aggressive and full of fight and does not develop any of the disqualifying faults named above he will probably make a good breeder. If he is cowardly and disposed to play the craven I would not advise using him to breed from. Cowardice in the cock usually indicates that he has been badly whipped at some time, or it may indicate that he is from stock that has been inbred too closely. Game fanciers who breed "pit" stock for fighting purposes will tell you that several generations of incestuous breeding will result in stags that are "quitters" and disposed to run after the first few blows are struck. A little "trying out," without allowing harm done, will often prove a better test of wind, lungs and heart action than any other method of trying the bird.

When you get a good, healthy male bird try to keep him in good condition. If he is attentive and gallant as he should be during the breeding season, he may easily get out of condition. Avoid this by removing him from the flock occasionally and feed a few tid-bits of fresh, sweet meat (cooked or uncooked), fresh, green food and a mixture of hard grains. You will run no risk by keeping him for a day or two away from the hens in a comfortable coop, where he is out of sight and sound of the females, and it may save him from wasting his energies in useless service. This is quite important, for an active, gallant and attentive male, when running with his flock, often does not eat a sufficient amount of food to keep him in good order. A little attention given to supplying him with occasional meals away from his harem will be well repaid in the results gained from a valuable

breeding bird. Keeping the male bird with the hens will not insure strongly fertile eggs unless he is well cared for, and kept in good breeding condition. Too many breeders overlook this matter or fail to consider it of sufficient importance.

Do not pen the breeding male up with other males in a flock where there are no females, it leads to bad habits or injury far more harmful than continuous running with a flock of hens. I believe that a good many excellent breeding males have been ruined in this way. Young males develop better and make better breeders when brought up with females and always allowed to run with them. So kept they are less liable to become sterile and as a rule make better all around breeders. The reverse seems to be true of pullets, they usually develop better, make better growth and give better results as breeders and layers when not subjected, during their period of growth from eight weeks to maturity, to the over-attentiveness and nagging of a lot of husky young male birds. Raise your pullets in a poultry convent, if you can, but don't try the monastic method of mangement for cockerels.

If necessary to take the male bird away from the female do not keep him away from them for too long a time, a few days each month for a little change and vacation are enough, except during the moult when he will be better off for a pen and run by himself until well feathered.

The Female.—The female breeders should be selected with as great care as the male. Where the requisites for selection of the male will apply to both sexes they apply to the females. Health and a sound body should be the first consideration. Constitutional vigor is as necessary in the female as in the male. Size and shape is the next consideration and then standard requisites for a good breeder. To a large extent the size and shape of the female parent governs the size and shape of the progeny, though it does not hold true in all cases. Choose well-grown, fully-matured females for breeders. Do not use birds that have had serious sickness. Choose good layers rather than exceptional ones. Prolific layers are more liable to produce infertile eggs than ordinary good layers, chiefly because of the greater number of eggs they produce and inattention on the part of the male, as he is less attentive to females that have been long established in laying, as a rule.

The breeding female should have a broad, deep body for the variety, legs of good size and well set apart, tail well spread at base; alert, active and busy; with bright plumage; bright eyes, a bit full; comb and face bright and of good, healthy red color; and other essen-

tials of a healthy bird mentioned in description of desirable qualities in male.

Unhealthy hens, or hens which have been sick, have no place in the breeding pen. The faults mentioned above as disqualifying males for breeding should also bar females from the breeding pen and, in addition to those faults already mentioned, no female should be bred that habitually lays misshapen or deformed eggs, or eggs containing blood clots. Hens broken down behind, or those having abdominal tumors, which cause abdomen to drag on the ground, should not be used in the breeding pen.

The use of trap nests is an invaluable aid in the selection of breeding females and in detecting sterile hens. Some hens seldom produce eggs that will hatch and from one cause or another are practically sterile. Such birds should not be permitted in the breeding pen. The men with the most experience in practical poultry work are not disposed to believe in any certain "egg type" that will indicate prolific layers. The good layers usually come in about all of the many types to be found in all varieties. The only sure means of determining which hens pay as breeders is to trap nest, keep an individual egg record and a hatching record.

Mating.—It is conceded that it is necessary to inbreed in order to secure the best results in fancy points. Some breeders go so far as to say that it is quite necessary to inbreed to secure utility values, like heavy laying and quick growing meat. I beg to doubt this last and will have to be shown. Introduction of new blood (crossing) usually stimulates egg production and promotes quick and good growth in the offspring of the cross. If it is true that inbreeding brings constant improvement in utility values, then why do so many practical men who grow for market show a preference for first crosses? Again, why is it that so many strains that have been subjected to incestuous breeding for generations do not show improvement in utility values, but are often found lacking in size, less vigorous, often sterile, and why should there be a tendency for their eggs to come smaller also? I have repeatedly found breeders who complain of such faults in closely inbred strains.

Where you must inbreed, be sure that the breeding birds are possessed of abundant constitutional vigor and let the relationship be as distant between the breeders as is consistent with obtaining the results you are working for. A noted pigeon fancier, who has bred a lot of good ones the past thirty years, told me that he had to inbreed very carefully and that he had always kept a record of all of his birds from the start and could know the relationship by reference to his records. He had found that too close inbreeding produced

undesirable results, loss of vigor, "idiocy" (and he showed me some pigeon "idiots" to prove his claim—they surely looked and acted the part), less resistance to disease, diseases of the nervous system and liability to "fits." He considered breeding brother to sister the most harmful form of incestuous breeding and stated that he had proved to his own satisfaction that it was not wise to breed closer relationships than uncles, aunts and second, third and fourth (or more distant) cousins. If this is true in pigeon breeding, why is it not true also in poultry breeding?

In mating up the pens avoid, so far as possible, using males and females possessing the same or similar faults (this is particularly necessary where inbreeding is practiced), as where the faults are similar on both male and female sides of pen there is more liability of a tendency to possess these faults in the progeny.

As a general rule, the best results in hatchable eggs and livable chicks will be obtained by mating fully matured, healthy cockerels with healthy yearling or two-year-old hens; or by mating a strong, vigorous, healthy yearling or two-year-old male and fully matured, well-grown, healthy pullets. Under such conditions there will be no cause for worry about the eggs producing weakling or imperfect chicks. Birds that are not full grown (fully matured) should not be bred. It is seldom advisable to breed birds that are more than thirty months old at the beginning of the breeding season.

Number of Females to a Male.—The number of females which may be successfully mated with a cock or cockerel depends largely upon conditions and upon the male bird. Commonly, ten females to a male is considered a sufficient number for a cock and fifteen for a cockerel. Some males will not properly care for half that number and some will serve well twice as many. Often a male, which in confinement would not give any too good results with a dozen hens, will easily serve twenty-five or thirty hens when on free range, with good results.

The number of hens a male should have also depends a good deal on how many of them are laying and how recently they began to lay. Test the eggs often by incubating them, for it is the only way to determine the result of the mating.

The Service.—The service is the "covering" of the females by the male, which should result in fertilization of the eggs. After the introduction of a male to the flock it is possible to obtain eggs in a few days that will hatch chicks of his get—though, if another male has preceded him, it may be two weeks (possibly longer) before all eggs can be safely credited as fertilized by the male last introduced.

How soon or how long after service impregnation of the egg takes place is not known. It is probable that it may occur as early as

within 16 to 24 hours after service, but it is certain that a much longer time often does elapse between the act of service and actual impregnation of the ovum. The sperm of the male is capable of living a long time in the oviduct, under favorable conditions, remaining active and possessing full power to impregnate any ripe non-fertilized ovum with which it comes in contact. Where crosses have been made it has been found that the character of the fluids moistening the lining of the duct undoubtedly vary in chemical properties in different varieties, so that, for example, the sperm of a Game might not live as long, or find conditions so favorable, in the oviduct of a Rock or Orpington as it would in that of a Game female, with the result there might be less fertile eggs produced. In some cases the reverse of these conditions might exist.

It has been proved by many experiments that one service, under favorable conditions, will often suffice to fertilize the majority of eggs laid from the second day thereafter for a period of two weeks. Some observers claim that one service is sufficient for one month, providing the hen is just starting to lay her litter at the time of serving.

From this it follows that it is not necessary to waste the strength of a valuable male bird in promiscuous and useless service. Where a breeder possesses a particularly fine male from which he desires to obtain the greatest number of chicks possible, he could be made to care for a very considerable flock by mating him only with birds about to begin their lay; or by dividing the layers into several flocks and permitting the male to run a few days twice a month with each flock, giving him a brief interval of rest and good care between, he could be made to cover a very large number of females.

It is quite practicable to keep a particularly fine breeding cock "at stud," as is common with other domestic animals and to bring females to him for service at regular intervals, say, once a week, or even every two weeks, always endeavoring to have the hen well served when about to begin her lay.

Fecundity versus Sterility.—It is often stated that the prolific layer after producing a considerable number of eggs is prone to become sterile, or that a large number of her eggs come infertile. Without doubt this is a fact, yet the fault does not necessarily lie with the hen. Often it can be proved that it is not the fault of the hen by giving her a new mate, when, as a rule, her eggs will again come a good per cent fertile.

This is, in part, explained by the fact easily observed, but to date mentioned by very few writers on the subject (Mr. E. Cook, author of "Incubation," published in England, was one of the first to give this explanation), that the male when introduced into a flock of hens

is soon surrounded by the layers or those about to begin laying and that he is usually particularly attentive to those near laying or lately become productive, while those hens which have been laying some time or which are unproductive are more or less neglected.

Failure to serve these prolific mates sufficiently often, and the fact that the male usually has his favorites in the flock, is in a large measure responsible for the proportion of infertile eggs produced. With prolific layers, there being more eggs produced, it is reasonable to expect that more eggs will escape impregnation, not because of lack of vigor (though that may enter into it in some cases), but often for the same reason that grass seldom grows on a well traveled road.

Where the service is frequent, eggs which escape fertilization in the first service may become fertilized by the second or any succeeding service. This explains why it is possible for a hen to lay eggs which produce chicks having the characteristics of more than one sire, although one of the parent males has been allowed to run with the flock but a short time. For example: If cock No. 1 has served a hen at the beginning of her lay and cock No. 2 be then introduced for service his seed will be likely to impregnate eggs which escaped the service of No. 1 (or the most active sperms of either may do the work), with the result that a part of the eggs in this hen's litter produce chicks that are the get of No. 1 and the balance the get of No. 2.

Some birds of both sexes are absolutely sterile—incapable of reproduction. This may result from many causes, but chiefly is due to disease or hereditary fault. When discovered such specimens should be killed and marketed.

Overshowing, in both sexes, is sometimes a cause of sterility. Any other form of abuse may produce a like result. Prolonged prolific laying combined with lack of care or insufficient food of variety sufficient for perfect egg-making, is another cause. Such sterility may be only temporary and when the bird is put in good condition, after a sufficient period of rest, good results may again be obtained. Where sterility is the result of hereditary taint or disease, no improvement can be expected.

Bringing up cockerels in celibacy often results in abuse and bad habits that cause permanent sterility. I have seen many good cockerels ruined as breeders by growing them in flocks of males exclusively, with no opportunity to run with the females. While it is undoubtedly a good thing to keep the pullets free from annoyance by young males while growing, it appears equally certain that males intended for breeders are better for being grown on range with a number of healthy adult hens. Males so reared are less likely to be abusive when introduced into the breeding pen and are much less likely

to "go to pieces" in a few weeks of breeding than cockerels grown by the monastic method. If for any reason it is necessary to herd a lot of young cockerels in a flock away from the females, be sure to put one or two strong old cocks with them to keep them in order and teach them good manners.

A male bird, given all the females he can attend to during his first season, will often wear himself out and become practically sterile and useless as a breeder the following year. Mating up the pens in the fall and permitting the birds to run together throughout the year is, in some cases, responsible for low fertility of the eggs from that pen. The cock bird needs intervals of rest, as do the females, but he should not be kept from his mates long enough to become morose and indifferent. Extremes in either respect bring unsatisfactory results. It is not reasonable to expect a male, that has been running with a flock of hens throughout a long season, to possess strong fecundity unless he has been particularly well cared for. See "care of the male bird."

There is only one way to test the fecundity of the male bird and that is by mating him to several females and then incubating the eggs from the mating. If the eggs do not show a good percentage of fertility, the male is probably useless as a breeder. If he is specially desired as a sire, he may be further tried out with one to three hens and the test repeated.

Sterile females can be identified by means of trap nests and individual egg records. If after incubating a number of eggs from any hen a large per cent prove infertile, try her with another male and test the eggs again. If she still fails to produce fertile eggs in sufficient numbers to make her worth using, discard her.

Hens with very long, downy fluff (like Cochins and Brahmas) will sometimes appear sterile when the trouble is interference with service. If the fluff is plucked or clipped, so that the seed of the male reaches its destination and is not lost in the plumage, they usually prove all right as breeders and produce their share of fertile eggs.

CHAPTER II.

Food—Vegetable, Animal and Mineral

FOOD is matter that is eaten for nourishment. It is nutriment that is fed upon by being received within the animal or plant and being assimilated supplies material for the building up and repair of the body or plant, furnishes energy for work and heat and supplies a surplus for storage for future need and a surplus for the purposes of reproduction. It is possible to feed fowls such a scanty supply of food that there will only be enough to support life and no surplus provided for storage (fat making) or for productive purposes. That is often the reason why poor feeders seldom get eggs.

All kinds of poultry are omniverous and require vegetable, animal and mineral food. The fact that they are omniverous does not mean that they can or should get along with one kind of food, but rather that variety is necessary and that to obtain results from our fowls we must feed all three sorts—vegetable food, animal food and mineral food.

The vegetable foods are those which are suplied by feeding on plant life, like clover, grass, alfalfa, beets, potatoes, grains, etc. Animal foods are those supplied by the flesh and bone of animals like meat, fish, green cut bone, beef scrap, milk and its by-products, eggs, etc. All vegetable and animal foods contain more or less mineral food. In addition to the mineral matter supplied in vegetable and animal foods, mineral foods are also supplied in salt, which is used as a condiment, and in grit, shells and dried bones. It is now believed by many observers that the most important part played by grit and shell in the economy of the fowl is not primarily a mechanical office, that of grinding food, but that a large proportion of it is properly digested and assimilated to serve as a necessary supply of mineral food, which is particularly rich in blood and feather making material.

The Chief Source of All Food.—Plant life is the chief source of all poultry food, of all foods, in fact. From plants and their productions we obtain our supply of animal food, since both cattle and sheep,

our most important food animals, are herbivora, feeding almost exclusively on vegetable matter (grasses and grains). Therefore we can consider plant life, in one form or another, as the most important source of all poultry food; either directly in the form of vegetables, grasses and grains, or indirectly through animals or insects which have fed upon plants and plant products.

This should interest us in the essentials of plant life that we may better understand food and what it is. In chemistry any substance which cannot be decomposed into different kinds of matter by any known means is termed an element. Among the elements which we know are essential to plant life are carbon, hydrogen, oxygen, nitrogen potassium, calcium, magnesium, phosphorus, iron, chlorine and sulphur. With the exception of oxygen the plant cannot make use of these elements in an uncombined form. Indirectly through certain bacteria which absorb nitrogen this element also may be received by some varieties of plants. Mineral matter in the form of salts of the mineral elements supply food for the plant, being taken up by its roots, and these occur chiefly as phosphates, nitrates, sulphates and chlorides of lime, potash, iron and magnesium. Hydrogen and oxygen in the form of water constitute a most important part of all vegetable matter. Some vegetables contain as high as 90 per cent of water. Water is, therefore, an important essential to plant life. Next to water, carbon dioxide (carbonic acid gas), a combination of carbon and oxygen, is largely used for sustenance and plant building. Sunlight supplies the energy for plant life and growth and also contributes something toward its development, causing the formation of chlorophyll, the substance which gives the green color to the leaves and stems.

How the Plant Grows.—All plants, like animals, are endowed with the life principle which directs their growth and development. In the seeds and grains this life principle is for a time dormant and waiting for proper conditions for awakening. Also, like animals, all plants are made up of a multitude of live cells and their productions. Each active cell is a living organism made up of encapsulated protoplasm and is capable of reproduction by the spontaneous division of the cell into two or more perfect cells. Protoplasm is a jelly-like albuminous substance.

From the sun the plant derives its energy for growth and development. This energy within the cells under the direction of the life principle works the wonderful changes which we observe in the growing plant. Carbon, hydrogen and oxygen in combined form as carbonic acid gas and water are absorbed by the plant as food and converted into carbohydrates in the form of starch, cellulose, cane sugar and

glucose. Vegetable oils or fats found chiefly in the seeds and grains are also manufactured by the combinations of carbon, hydrogen and oxygen.

Nitrogen and sulphur, taken up by the plant roots, in the form of nitrates and sulphates, are combined with a portion of the starchy matter to form a nitrogenous compound known as protein. Protein is a complex nitrogenous substance, the most important food element, and, so far as known, the only one that can be converted into flesh and body tissue when assimilated by an animal. Cell protoplasm is a protein substance. Gluten, an albuminous substance found largely in grain, is another example of protein compound. Various other protein or complex nitrogenous compounds are concerned in the make-up of the plant or its products and the value of the vegetable matter as a food is based upon its protein content.

Food Elements.—For convenience of study and because of their chemical composition and special uses as food, all elements are divided into groups so that foodstuffs may be said to contain but five essentials: Water, which is always present, no matter how dry the food may appear to be, ranging from as low as 10 per cent to as high as 90 per cent; protein, consisting of albumin and other nitrogenous compounds; carbohydrates, non-nitrogenous compounds like starch, cellulose, sugar and glucose; fats or vegetable oils, and ash or mineral matter.

The plant food when consumed by the animal becomes converted into tissue building material, fat, and energy in the form of work and heat. The waste which is voided by the animal serves as fertilizer, returning food elements to the earth. The process is further continued by the animal becoming food for other animals until eventually the food elements, multiplied by the manufacturing process going on in all living matter, whether vegetable or animal, are returned to the earth or air to serve as a source of food for repeating the process over and over again.

Protein, a complex nitrogenous compound, is the most valuable constituent of all food. Animal protein (contained in meat food) is considered more available and more perfectly digestible than vegetable protein. It has been demonstrated that some animal food is necessary to health of poultry. How animal protein differs from vegetable protein we do not know, but the latter will not completely take the place of animal protein. Protein is the most valuable and it is the most costly food element. It has the widest range of uses within the body. Its chief value is as a tissue builder. It furnishes material for tissue building and repair. It contributes largely to the manufac-

ture of eggs. It is convertible also into fat and heat. The waste from protein is more dangerous and more difficult to get rid of than that of other food constituents, so that aside from an economical point of view, it is unwise to feed a very narrow (excessively nitrogenous) ration.

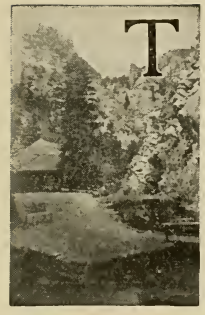
Carbohydrates are believed to be chiefly heat producing. They supply fuel, energy, to be converted into work and heat. Whether or not they are available for any other purpose is still an open question. It is thought that they cannot be converted into fat, but act rather as a fat saver by furnishing fuel to be consumed in place of fat. In experiments with ducks fed abundantly on rice, which contains much carbohydrate and little protein and fat, the ducks remained lean; when fat was added to the food they put on fat. The liver, besides manufacturing bile for use in digesting and assimilating food, seems to act as a manufactory and storehouse of partially converted carbohydrates and it deals them out in the form of a partially converted starch that is readily transformed into a sugar easily assimilated by the tissues. Where carbohydrates are greatly in excess of their due proportion in the ration, a too starchy diet, the liver is overtaxed and we get so-called "liver troubles."

Fats are available for energy, work and heat, and may be stored for future use within the body, or so disposed of as to be of service as insulators to protect the body against too rapid loss of heat. They serve as fuel for growing and working cells. The fats are carried to the cells in the form of minute fat droplets and undergo chemical changes within the cells before being deposited in storage as fat tissue. Fats also contribute their share to egg formation. Fats are important food and necessary to life and health. An excess of fatty food is not desirable.

Mineral matter, or "ash," is found in all foods and is usually present in sufficient quantity to supply the needs of the body, provided a good variety of food is fed. It is chiefly concerned in the building of bone and making egg shells, although it is found in varying quantity in all of the tissues of the body, to all of which a supply of mineral matter in one form or another is essential to the life and health of the individual. It is believed to also play an important part in the digestion of food by aiding assimilation. It is claimed that in some sections, owing to the depletion of the soil through frequent growing of large crops and through use of soils lacking in some essential minerals, our grain foods are less rich in mineral food than formerly, and therefore it is now more than ever necessary to supply our fowls with mineral food in another form. This is a matter which needs careful investigation.

CHAPTER III.

Fowls and Food



THE living fowl is often likened to a machine, but the comparison is hardly just to such a wonderful complex organism as the living body. It is more like a living city peopled by a myriad of live cells, each with its own duty to perform. There is a great supply system for receiving food and fuel, the digestive and respiratory organs, which, with the tissues, also represent great manufacturing plants capable of converting food and fuel into heat, work and building materials for the repair, maintenance and development of various parts of the body. With these manufacturing plants are intimately connected great storehouses to be called upon in time of need, like fat tissue and the liver. There is a great system of transportation, the circulatory system, for carrying supplies and some workers to various parts of the body, and returning waste products to the excretory organs, which last represent a most remarkable system for getting rid of undesirable matter. Then there is the nervous system, which has its headquarters in the brain and spinal cord, with substations and telegraph lines communicating with all parts of the body, which governs, polices and regulates the whole. Presiding over all this is something supreme and about which we know next to nothing—the Life Principle.

It is not remarkable that when we attempt to convert this wonderful living body—the like of which we have no power to create and which we cannot make live when death has grasped it, but which possesses the ability to reproduce itself while living—into a mere man-made, man-operated machine, we meet with obstacles which we fail to understand the meaning of. The wonder is that we succeed in controlling it and making it serve us as well as we do.

The Living Cells.—The fowl's body, like the live plant (see Chapter II. "Food—Vegetable, Animal and Mineral,") is made up of an infinite number of living cells and their productions. These cells have various duties to perform, and while some are confined to their special department and gifted only with passive movement, there are others

more active which travel all over the body. All are concerned in the maintenance of the body. Some of the active cells serve as an army to repel invaders in the form of disease germs. As long as this army has its ranks well filled with normal healthy active fighting cells, always to be found in the normal healthy body, there is little danger from the germs of disease. It is only when the army has been abused, ill fed and ill treated, put out of good fighting trim, that invading disease germs get a foothold and the upper hand, and this army of fighting cells has wonderful recuperative and rallying powers and only needs to be given a fair chance to drive out the invaders. A few cells may neglect their duty and no harmful result is apparent; but let a number of cells combine and, like organized labor, go on a strike for cause, then there will be trouble until the cause is removed and the dissatisfied population is put to rights again.

Chemistry of the Fowl's Body.—Chemically, the fowl's body is made up of water, protein, fats, mineral matter and some carbohydrates (partially converted starches and sugars, these appearing chiefly as stored fuel manufactured from food). Accurate knowledge of the chemical compounds which exist in the living body and their exact disposition and relation to each other is practically impossible, as in order to make an analysis the complex living matter must be killed and broken down, leaving only the debris for examination. Accurate knowledge of the changes which take place during the digestion and assimilation of food is likewise difficult, as we must first induce an unnatural condition or kill the fowl before we can observe what is going on within it. The restraint and fear brought about by handling fowls under observation produces unnatural conditions which interfere with any attempt to observe body functions. Obviously much must be left to be drawn from theory. The theories, however, are ably supported by the result of careful experiments based upon them.

It is possible to prepare food of known chemical composition, and after feeding same and making an analysis of the waste disposed of, to estimate the amount of each constituent of food digested. But the conditions governing the experiment are necessarily artificial, and the results do not show how the fowl disposes of what it digests or that a fowl would digest a like proportion of food in a like manner under normal natural conditions. The fact that the experimenter is dealing with a complex living organism, subject to influences of which he has little or no accurate knowledge, makes it difficult to approach anything like exactitude in results. A skilful experimenter, no matter how sincere and honest he may be, may deceive himself and he may "prove" almost anything he sets out to demonstrate to his own satisfaction, and that of his following, when handling live stock. All

he can really show or prove is that under certain conditions, with certain fowls and certain methods he obtained such results, but another man with different fowls may follow his lead as exactly as it is possible for him to do, and the results will be widely different. Could several experimenters conduct the same experiments in the same manner and arrive at the same or very similar results and be able to repeat the same experiments with the same results for several seasons, then we might consider we had some real proof, but to date we do not know of any such.

Disposition of Food Varies With Individuals.—It has been demonstrated by experiment with animals that the difference in individuals in the proportion of the food digested of a given ration is not as great as is popularly supposed. This may be a fact but there is nothing to show that each individual makes the same use of the food digested. Several individuals of the same variety might digest a like amount of the different constituents of a ration, but the disposal each would make of the digested matter would vary widely. One might make heat and fat where another converted it into eggs and meat.

The disposal of digested matter will vary from time to time according to the needs of the individual and according to the manner in which different parts of its body assimilate certain food elements or perform certain functions. "Nature" will choose as she elects and not wholly as we may direct. An exactly balanced ration that will cover all conditions and meet all individuals on a common ground from day to day with uniformly good results is not practical, possible or desirable. To balance a ration as accurately as some folks would have us believe they do it, would require the gift of second sight and a daily change in the make-up of the ration and its food values. Such finickyness is not necessary.

The chemical analysis of a food is of value only as it shows us the make-up of the food, and saves us from feeding an excess of costly unnecessary material. We cannot have an analysis of each lot of food purchased (even if desirable) and different samples will vary widely in make-up, so we are obliged to depend upon the average chemical composition of the foodstuffs used. A glance over the analysis tables of U. S. Government reports will show that even the grains vary considerably with the different samples of the same grain examined. For practical feeding purposes it is safe to accept the whole grains, when sound, at the average nutritive value set for them. With ground grains and meat foods and commercial mixtures age and storage may shrink their value considerably, and, when trouble appears in a flock from unaccountable causes, it will be well

to look carefully into the composition of these manufactured foodstuffs and see if therein can be found a cause for trouble.

Chemical analysis of a food is never an index of its digestibility or palatability. Two similar foods might show the same chemical analysis and one be good food and the other positively unwholesome. Palatability is essential to digestibility. Don't give too much importance to mere chemical analysis of foodstuffs. There are other things much more important.

Variety of Wholesome, Palatable Food Is Necessary.—The man who spends much of his time figuring out a pseudo-scientifically, chemically balanced ration and wearies his brain with "nutritive ratios," potential energies, etc., will not, in nine cases out of ten, be anything like as successful as the man who studies his fowls and feeds them according to their appetites on a variety of good honest plain wholesome food.

It is essential that food shall be pure, palatable and digestible. A food may show by analysis an "ideal" chemical composition and yet be neither palatable or digestible. Depend upon it that food that is not consumed with a relish will not yield you as good results as food that is sufficiently palatable and appetizing to make your fowls eager for it. So far as the daily balance of the ration is concerned, it is safer to leave that to the instinct of the fowl than to man's invention, particularly when the mixture is compounded chiefly for commercial purposes. The fowl's appetite is not an infallible guide, but if the fowl be given a fair chance to select its own food it can be depended upon to do fully as well or better than it would when provided with an elaborate "scientifically compounded" mixture. There has been a mighty abuse of the name "science" as applied to foods and poultry feeding.

Balanced Ration Is Desirable.—The foregoing does not mean that we should pay no attention to balancing a ration so that the protein and other food elements will bear a reasonable proportion to one another. The protein or nitrogenous food elements are more costly than non-nitrogenous elements and for economy's sake we do not want to feed an excess of high cost food when cheaper food values will answer our purpose just as well and perhaps give us better health in the flock. It should also be remembered that the waste from highly nitrogenous food is by far the most difficult to get rid of and the most dangerous to the health of the individual if not properly voided.

Foods may be balanced according to the object of feeding whether for breeding stock, laying or market meat and fat. As a rule a narrow or medium ration should be fed to layers, for breeders a medium

ration with an abundance of green food to supply as nearly as possible food conditions nature provides for the breeding season, while for fattening and for heat production in cold weather a rather wide ration will serve best.

A ration containing proportionally one part of nitrogenous matter to three of non-nitrogenous matter would be considered a narrow ration and would be spoken of as having a nutritive ratio of 1:3. 1:4 is narrow enough for practical purposes. One having a ratio of 1:5 or 1:6 would be a medium ration and a wide ration 1:9 or thereabout.

So far as balancing rations goes there has been a great deal of nonsense connected with it. Rations which vary widely in the nutritive ratio are giving equally good results in the hands of different poultry keepers. It is undoubtedly wise to roughly balance a ration by offsetting a heavy supply of carbonaceous food with some nitrogenous matter or vice versa. It is not necessary to provide elaborate mashes with a multitude of ingredients.

So far as possible it is undoubtedly the safest plan to observe the flock carefully, note the work done, and try to feed according to what seems to be the immediate need. Let appetite and inclination of the flock as a whole, combined with the work it is doing and the object you have in view be the guide to the make-up of and for any changes in the ration. The nutritive ratio may fluctuate from narrow to wide and the results be excellent. It isn't necessary to sit down and figure out the chemical values. You simply need to know that such foods are rich in nitrogenous matter or tissue and egg building material and what others are rich in non-nitrogenous matter or heat and fat producing elements and to strike a rough balance according to the needs of the flock and the requirements of the season and the results you wish to obtain. If you will observe your flocks carefully, take note of what you feed and its effect, you should have no difficulty in learning what foods and what proportions are best suited to your needs.

Whatever you do give the birds a variety of good sound wholesome food.

A chemically balanced ration simply means that there is maintained a certain relative proportion between the nitrogenous and non-nitrogenous constituents of the food fed. The precise proportion that is most desirable has never been positively fixed and different writers have placed the ratio as narrow as 1:3 and as wide as 1:9, each claiming, and without doubt having good reason for his claim, that the results from his ration were excellent. Recent observers

have apparently "split the difference" and the range of the ratio has been presented as 1:4 and 1:6.

I do not consider that it is at all essential for the every-day poultryman to bother himself with the theory of food chemistry or with the details of chemically balancing rations. There are plenty of good practical rations from which he can make his selection and all of them are sufficiently well balanced chemically for all practical purposes—so why worry over non-essential detail which requires special training and study for even an understanding of the first principles?

If we feed a good variety of wholesome food and enough of it, using the common grains, greens, animal food and mineral foods recommended in the majority of practical rations, in every-day use by practical successful poultrymen, we will have a fairly well proportioned balanced ration. Such a well balanced ration will contain a sufficient variety of grains, some roughage (green food), animal food (beef scrap, meat meal or milk in some form) and in addition to that contained in the foregoing, mineral food will be supplied in form of grit, crushed oyster shells and granulated dry bone; a surplus of all food elements necessary to maintain and build up the body and to secure in addition the results in eggs and meat that are desired.

Obviously such a ration must contain sufficient variety and enough elasticity to meet the requirements and individual needs of all members of the flock. We cannot set a separate table for each individual and will have to afford our fowls the opportunity to do a little balancing on their own account. We will have to observe the fowls, note their appetites and preferences and vary our ration a little from time to time in the endeavor to supply the fowls with what they crave most—for in most cases what they crave they need. This general rule will not hold in the exact letter to abnormal cravings and perverted appetites due to illness ,neglect or bad management, but we must bear in mind that an abnormal craving, or the feeding on feathers, eggs, sticks, filth, etc., in a fowl that appears otherwise healthy is an indication that she needs and craves something that we have failed to suply her with. Dig up your powers of observation and your common sense and use them to locate the trouble and remedy it. The simplest method of narrowing or widening a ration is to add to it or take from it a quantity of animal food (meat, scrap, or milk). Heavy feeding on grains and meats calls for an abundant supply of greens (fresh if obtainable) to keep the fowl in good condition. This last applies in all cases except the last two or three weeks of fattening for market.

Live Food Is Needed.—In addition to the food elements I have

mentioned herein and in Chapter II., there are other things necessary to the proper feeding of fowl. Of course it is understood that the fowl must have good care and be kept well housed under sanitary conditions. It must have plenty of fresh air day and night to supply free oxygen necessary to life and which when inhaled and taken up by the blood in the lungs goes to the tissues to assist in the chemical changes that occur there. It must have sunlight, which is almost as important as fresh air. It must have exercise to insure a healthful condition of the body and to aid in the proper disposition of its food.

There is also something contained in the live cells of fresh green stuff that possesses health-giving, disease-preventing properties. We do not know what that something is, but we know that it is there and that it is necessary; it is spoken of as the "antiscorbutic principle." In a measure it is found in live uncooked foods of all vegetable sorts, but it is most abundant in fresh succulent green foods.

Cooking of food destroys the live cells and does not add anything to the food except bulk, renders the starch more easily digestible and sometimes makes the food more palatable. Cooked food is chiefly of service in adding variety to the ration and in the case of damaged foods, and particularly meats, cooking will destroy undesirable germs. An allowance of cooked food two or three times a week will afford a desirable variety, will stimulate the appetites of the fowls and may be considered a help toward better results. Do not feed fowls or chicks on an exclusively cooked diet if you wish to keep them well and strong. Cooked grains should be fed sparingly and not too frequently.

Digestion of Food—Maintaining Body Temperature. — The true digestion of the food does not take place in the crop, stomach, gizzard and intestines alone. It takes place all over the body, in the tissues. Suppose the bird to have been fasting. Food is taken into the crop, and the activity of that organ in supplying fluids to soften the food at once starts heat generation. The muscular contractions in forcing the food onward also make heat. Heat production increases rapidly as the work of digestion progresses. After the food is mixed with and softened by the secretions of crop and stomach (proventriculus), dissolved, mixed and reduced to a paste in the gizzard and combined in the intestines with juices from the liver and pancreas, it is taken up by the circulation and carried all over the body to meet the demands of the tissues. The living cells select what they require and make it over to suit their special purposes. In the chemical transformation which takes place the energy contained in the food is further converted into work tissue repair or building, and heat. Unavailable matter, waste from the manufacturing or building up and breaking down processes going on in the tissues, is returned to the circulation

and carried back to be mixed with refuse in the intestines and is voided as droppings. The maximum of heat production, which began with taking food into the crop, occurs some six or eight hours after the meal. The activity of the organs of the body, muscular activity, building up and breaking down of the tissues, all contribute their share to heat production.

How is the normal body temperature maintained with all this production of heat? Heat is lost to the body in a variety of ways. Some is carried off in the exhaled breath, more is voided with the droppings, and some is disposed of by radiation from the surface of the body. Too rapid loss of heat is provided against by insulation of the body with fat and by clothing in the form of feathers. Throughout the life of a healthy fowl this heat expenditure is under the control of a delicate system of regulation, a part of the nervous system. These heat regulator nerves control the rapidity with which heat is expended and have the power to excite heat production and so maintain the body temperature at the proper degree. Whether the heat production within the body be rapid or slow, in health the body temperature remains about the same all the time and under the control of the regulating system. While this covers the subject only roughly and without scientific detail it probably goes into the subject as deeply as the poultryman will find time and patience to consider, but this brief outline of "boiled down physiology" should prove an aid to a better understanding of fowls, foods and feeding.

Exercise.—Exercise is of vital importance to the health of the fowl and to proper assimilation of food. Breeding, laying or growing stock must have plenty of exercise to do well and to assist them in using their food to the best advantage through the proper channels. Without exercise, food, which under normal conditions should be burned as fuel, used in the repair of tissues or making eggs, will be diverted into forming additional flesh or fat. Keep the birds busy by feeding a portion of their hard grain food where they will have to scratch for it. The busy active hen, that scratches for a living and is frequently seen tail deep in the litter with the dust flying behind her and that sings as she works is usually the hen that produces the strong germed, fertile eggs that hatch well.

With healthy hens it is seldom necessary to force exercise. Given the place and opportunity they will generally take sufficient exercise without much urging. Exercise is a good thing, it is necessary, but it is possible to have too much even of a good thing. The overtrained athlete or the man who takes "physical torture" exercises is seldom the equal in health, endurance, and disease resisting power of the man who exercises normally and naturally. The same applies to your

fowls. Let them scratch for a PART of their grain but do not make them work for ALL of their food. You do not want to burn up a considerable part of the food you feed in unnecessary excessive exercise; that isn't economy in feeding. Neither should you get your fowls out of condition by failing to give them an opportunity to scratch and run about a sufficient amount to keep their digestion in good order. Try to strike the happy mean between extremes.

Give the Fowl a Chance.—The fowl will balance its own ration if it has a chance. Do yours get a chance or are they confined in cramped quarters with bare hard runs and obliged to live on whatever you throw out to them? Give them a chance. Supply a variety.

If permitted to range and find its own food the fowl will live chiefly on grains and seeds, an abundance of green food when available, quantities of worms and bugs, some grit and pieces of shell and drink freely of water. The ration will have a wide variation according to the success of her foraging and it will be largely such food as nature provides in season. Yet, if the fowl has the range of a good-sized farm, gets a good feed of corn on the ear before roosting time and has good sleeping quarters, the results are generally good.

Poultry farmers, who make their living from the fowls, often let the fowls balance their own rations, simply keeping boxes of wheat, corn, oats and meat scrap before them and supplying plenty of cabbage, roots or greens in season. These fowls often do quite as well as flocks that have more elaborate rations. The presiding life principle within the fowl, which dominates its nervous system and impels it to do certain things, is responsible for the success of the fowl left to its own inclinations. Where things do not go as they should, some morbid condition has interfered with the normal conduct of the living organism. There is nothing to be gained by attempting to treat the fowl as if it were a machine into which a definite amount and quality of fuel can be fed resulting in a given amount of work. Nature does not work that way.

If under ordinary normal conditions where the fowl has liberal range and an opportunity to balance its own ration it gives satisfactory results, why not endeavor to achieve similar results by giving the fowl a chance to balance its own ration when confined in a pen or yard? There is a wide difference of opinions on the subject of poultry feeding just as there is in the matter of diet for human beings. It is seldom that you will get together a body of "experts" who will agree on either subject. The reason is not far to seek for the diet must vary with the needs of the individual or the particular group of individuals, and at times will vary with the particular object we have in view. The saying that "what is one man's meat is another's

bane" may be trite but it is none the less true. To a certain extent this saying will also apply in poultry feeding, and when experts disagree we must seek our own salvation with our own observation and common sense. Study the fowls, keep them comfortable, well fed and contented. If they are not content, they are not well fed and cared for, and if they are not content, well fed and well cared for they will not be comfortable.

Sea beach free range for sturdy breeding stock on a Rhode Island practical poultry plant. These hardy, healthy birds produce an abundance of good, hatchable eggs. (Photo by Dr. Woods. Mrs. Woods is at right of house, driving the fowls up from the rocky beach.)

CHAPTER IV.

Care and Management of Breeders

THE IMPORTANCE of breeding, feeding and managing fowls first and always for HEALTH—for sound constitutional vigor—and after giving first place to health breeding for such other qualities as may be desired, has been emphasized in the preceding chapters. So many poultry keepers fail to observe even ordinary precautions for making sound constitutional vigor a foundation characteristic in their strains or flocks that I repeat here: Whatever else you do, BREED FOR HEALTH, house, feed and manage for health and comfort.

Like begets like in health quite as much as it does in type or plumage. The only safe way to build a foundation for the prevention of disease in young chicks and in all of your flock for all time, is to breed only from strong, vigorous, perfectly-formed, full-grown, healthy specimens, birds that possess vitality and lots of it.

Handle every bird and discard every specimen that shows any deformity. Pick out good-sized, full-grown, active, alert males and females. Never breed very young or very old birds. Immature pullets and cockerels, or, as a rule, birds under twelve months old, cannot be depended upon to give satisfactory results in breeding. Fowls that are three, four and five years old, are very liable to quickly get out of breeding condition. They may be overfat internally or diseased in some other way. When you must use an old bird for breeding, be sure that it is in good, sound, vigorous condition and that the specimen is one that has never been at any time seriously sick. These details are all of the greatest importance, for without sound, healthy, vigorous foundation stock you cannot get vitality into the succeeding generations.

You cannot use too great care in the selection of your breeding birds. Remember that the losses in little chicks are due chiefly to a lack of vitality. Unless your breeding stock possess an abundance of vitality they cannot be expected to impart vitality, or the power to live, to their offspring. Breed fine feathers if you will, but don't let

your fondness for beautiful plumage lead you so far astray that you are blind to all else. On several occasions I have purchased breeding birds of well known established and reliable fanciers, one of whom at least was and is considered an authority on poultry diseases, yet I have had, when buying birds from these parties, frequent cause to complain because the specimens sent me, while excellent in plumage, were sadly lacking in physical development. Once I purchased a breeding male which was described to me as a husky, healthy specimen and "boss of the yard." When the bird arrived he had a slightly wry tail, a slightly deformed back, and a decidedly crooked breast. Two females purchased from a breeder in whom I had great confidence were beauti-

Corn stover piled against a wire fence makes an ideal wind break for an outdoor scratching place for breeding stock. The White Plymouth Rocks in the illustration enjoyed the south side of this stover stack every fair day all winter long and they gave a good yield of eggs that hatched well and produced strong healthy chicks. (Photo by Dr. Woods.)

ful specimens to look at when viewed on the ground. Handling them showed decidedly crooked breast bones, a deformed shoulder and deformed back. Although I had paid a fair price for these birds, I would not breed them. By breeding deformed specimens you invite trouble.

Housing.—When you have selected sound, healthy breeding stock, keep them healthy by good housing, good food, good care and good management—in one word, COMFORT.

Comfort is the keynote to keeping fowls healthy, happy and con-

tented. If ill housed, ill fed and ill cared for they won't be comfortable. In my book "Open-Air Poultry Houses" I have described the open-front buildings, which I believe are best and most comfortable for poultry. For breeding stock I believe that the colony type, open-front, open-air poultry house is the best house to use. Such houses may be single walled and built of matched boards, may be covered with waterproofed building fabric, or, as I much prefer them, shingled on roof and three sides, but the fronts should be open and covered only with fine mesh wire netting. As a dependable all the year 'round house for climates where the winters are cold, a good open-front house with sufficient depth in proportion to the open front is undoubtedly the most satisfactory. Colony houses are to be preferred to long continuous houses, as it is easier to provide for abundant range with colony buildings and there is less danger from disease where there is one flock instead of many under one roof.

If you have no buildings of the open front or fresh-air type, try the next best thing and convert your closed poultry house into a semi-fresh-air apartment by substituting for the upper halves of the windows in the south front of your buildings a screen of unbleached muslin loosely tacked on a wooden frame. Air out such buildings daily in cold weather by opening the windows. In summer take the windows out and leave them out. Remember that to keep birds healthy you must let them have fresh air to breathe both day and night. The fresh air is of even greater importance after the birds have gone to roost than it is during the daytime when they have an opportunity to run in and out of doors. I have been using open-front or "fresh-air" poultry buildings for a number of years. The results are so satisfactory that I am building more of them, and I do not want any other kind of house for breeding fowls or for layers. In the fresh-air buildings fowls are easily kept in health and are not susceptible to sudden weather changes. Breeders can run out of doors at all seasons of the year; in the winter time they can run on ice, snow and frozen ground, scratch around stacks of fodder out of doors, and they seem to take delight in so doing.

Range and Yards.—Breeding fowls do best on free range, or at least wide range with abundant grass land and shade. If free range cannot be had, then give the breeders all the yard or park room you can. You may and probably will get more eggs from birds kept in confinement, but what you want is quality in the eggs, not quantity of eggs, and you will get better chicks in the long run from fowls that have ample range. If the range is unrestricted, so much the better. Scratching litter may be provided in the houses if you must do so, but in many localities litter in the house invites dampness, and dampness may result in mustiness, mold and disease. Where the birds can

have outdoor range in winter, and always when they have outdoor range, you will find that a straw stack, pile of corn stover, or heap of any good litter, placed near the south front of the house, or ranged along wire fencing as a wind break, makes an admirable outdoor scratching place at all seasons and will help to keep the birds in better condition and prove an aid in securing more hatchable eggs.

When it is said that the fowls can run out of doors at all seasons it does not mean that you are to compel them to go out in bad weather to seek food. Provide an outdoor scratching place and then give the birds an opportunity to go out of doors to scratch about when they want to. See that they have ample protection from chilling winds. It will not do your birds any good to run about in cold winter rains or to paddle about much in snow and ice water. They will be better off in the house than squatting or huddling in some place out of doors exposed to chilling winds in late fall, winter and early spring. Here, as in all other matters concerning the management of the flock, the attendant must consider the comfort of the fowls. The important thing is to keep the birds comfortable, contented and happy.

Foods and Feeding.—Feeding the breeding birds is not a matter of trying to get the most eggs the flock will yield. You want eggs that will hatch well and that will produce strong, sturdy chicks. Number of eggs is of secondary importance. After many years of experience with poultry and with both moist and dry mashes I have abandoned the continuous feeding of mashes to breeders. As an aid in promoting egg production some sort of well-made mash appears essential to getting the most eggs with the least time and trouble. For breeding birds the mash is better fed as a supplementary ration and supplied only occasionally.

Where mashes, either moist or dry, are fed daily or five or six times a week, or dry mashes are kept before the fowls, there is always more or less tendency to indigestion and bowel trouble. Dry mash appears to cause less trouble than moist mash, probably because it is not so freely eaten and gets the same action from the digestive fluids as does other dry grain food. Mash three or four times a month to supplement a hard grain ration won't do any harm and may do good. If so used you will get the most out of it by scalding it and allowing it to cook overnight in its own heat, or by cooking it in a food cooker. There are a number of combinations which may be used, and the following is excellent:

Mash.

Best short cut alfalfa hay, or fresh cut green rye, shredded corn fodder, or fresh cut green clover ..... 10 pounds

Wheat bran	10 pounds
Cornmeal	10 pounds
Buffalo gluten	10 pounds
Wheat middlings (white)	10 pounds
Best fine sweet beef scrap	5 pounds
Best commercial fish scrap	5 pounds
Table salt	½ pound

If the mash is to be fed moist scald the animal food and dry cut alfalfa with hot water to which the salt has been added and then mix in the ground feeds. Feed when warm but not hot. Give this supplementary food at times when the birds seem to need a little toning up; give what they will clean up readily in from fifteen to twenty minutes. Some months I feed it twice or three times a week and some months not at all. The time of feeding may be any time that is convenient and that the birds seem in condition for it. Moist mash is fed only as a supplementary or variety food. The ration should be mainly dry.

The regular ration should be sound, hard, dry, whole or cracked grains. These may be hand fed, hopper fed, or fed by a well-constructed automatic feeder. I am disposed to favor the automatic feeder as a labor saver and because it feeds any quantity you wish as often as the birds want it all day long.

The dry grain mixtures may vary according to the supply available and the prevailing prices of grain in your locality. Sound, sweet grain that has not been "heated" and that is free from mold or mustiness is the only kind that is fit to use. There is no economy in using damaged or "heated" grains just because the price is low. Such are not "cheap" at any price.

For hopper feeding, if you can have a hopper with several compartments it is a good plan to let the birds balance and mix their own ration. Simply keep corn, cracked corn, wheat, oats, barley and beef scrap in separate compartments of the food hopper and keep each compartment filled. The fowls will do the rest and they will balance the ration much better than you can. There are objections to this plan and the chief one is that in some localities much grain will be stolen by rats and mice. Some flocks will waste some of the grain, but this occurs so seldom as to cause but little trouble. Under this system of feeding, unless the range is ample and the weather favorable to ranging, some fowls, particularly old hens, are liable to fill up at the hopper and loaf around until they are hungry again. This does not happen with many individuals or with all flocks and is most common with old hens that had always been used to the hand-feeding method.

Hand feeding requires two regular feedings of grain a day, with

beef scrap fed in the hopper or else coarse scrap scattered with the grain and one feeding a day of green food.

Automatic feeders require the use of grain mixtures, but they save labor, prevent waste and loss and keep the birds busy feeding throughout the greater part of the day. Properly built, you can adjust them to feed much or little, as desired. I like such a feeder large enough to take a bushel of grain or more. The fowls are watched and if they show preference for any grain they get more of it in the mixture next time, or if they slight any grain they get less of it. Here are four good grain mixtures and suggestions for use of same:

Spring and Fall Grain Mixture.

Best cracked corn	40 pounds
Whole corn	10 pounds
Hard red or amber wheat	30 pounds
Heavy clipped white oats	10 pounds
Best full-meated barley	10 pounds
Coarse sifted beef scrap	5 pounds

Good solid white wheat may be substituted for the red wheat or the amber wheat if the price favors such change. Oats should be the best heavy white oats running from 38 to 42 pounds to the bushel. Oats that run less than 34 pounds to the bushel are too light in weight. Barley may be substituted for oats or oats for barley, according to the prices and the quality of each. Feed the best value you can get for your money. Barley should not weigh less than 50 pounds to the bushel, and the heavier it is, if the grain is sound and dry, the better.

Winter Mixture.

Whole corn	30 pounds
Best cracked corn	35 pounds
Wheat	25 pounds
Heavy white oats	10 pounds
Coarse sifted beef scrap	5 pounds

Five pounds of either barley or buckwheat may be substituted for five pounds of the oats, or both may be substituted for the entire amount of oats, according to market prices and convenience.

Summer Mixture.

Cracked corn	30 pounds
Wheat	40 pounds
Heavy white oats	15 pounds
Barley	15 pounds
Coarse sifted beef scrap	5 pounds

Ten pounds of kaffir corn may be substituted for five pounds each of oats and barley if desired.

Variety Grain Mixture.

Sometimes I feed at any season of the year, for the sake of variety and because I am able to buy same cheaply, a variety grain mixture made up approximately as follows:

Cracked corn	40 pounds
Whole wheat	20 pounds
Clean wheat screenings	20 pounds
Kaffir corn	8 pounds
Heavy white oats	6 pounds
Silverskin buckwheat	4 pounds
Russian sunflower seed	1 pound
Golden millet	½ pound
Whole flaxseed	¼ pound
Hemp seed	¼ pound
Coarse sifted beef scrap	5 pounds

This variety mixture will be found very satisfactory to use when the birds are moulting.

In addition to the grain food and beef scrap you should keep before your fowls at all times clean gravel or grit, crushed oyster shells, poultry charcoal, granulated bone and pure drinking water. These are all essentials and should not be neglected. Only good, sweet, sound grains should be used in above mixtures. Moldly, musty or dusty grain should never be fed, as it is liable to make the fowls sick. If at any time it should come to a choice between feeding moldly grain or starving the fowls, then scald the grain well, stir it around in the hot water and dry it out in a hot oven before you feed it. This is a lot of work but it will save a lot of trouble.

Animal Food.—Worms, bugs, grasshoppers and other insect life are the best animal foods for breeding stock, but it is very seldom that the supply is sufficient even for a short period and there are always times when none are to be had. Commercial beef scrap has to be our main reliance for all seasons. The best of it is poor enough, and much that masquerades under the name of beef scrap is not fit to feed.

Good beef scrap should be medium coarse, contain some particles of bone and meat, the size of wheat and corn as well as the meat meal portion, should be from a light to dark coffee color, have a strong, sweet, rich, meaty odor, should be free from lumps and should always feel rather dry and crumbly. On scalding there should be no offensive odor. Beef scrap that stinks like fertilizer when scalded is not fit to feed. Scrap that is damp, full of lumps that show white on breaking down, is almost certain to poison your fowls.

Fish scrap is a rather uncertain product and contains a large percentage of soluble fish bone. It is a by-product of some fish-glue fac-

tories and is sold for poultry feeding. When of good quality it makes a good animal food for fowls and chicks added to mashes and used as a substitute for a part of the beef scrap. Don't feed fish scrap from a hopper.

Fresh, sweet fish (either fresh-water or salt-water fish) is one of the best animal foods for either breeding stock or growing chicks. Boil or scald the fish and feed it plain or mixed with bran and meal or with mash mixture (beef scrap being left out of mash when fish is fed).

Beef scrap should be fed plain from a hopper, in addition to that in grain mixtures, and should be kept always before the birds. After the first greedy feeding they are not likely to eat too much of it.

Salt fish is a help where fowls must be confined. Simply hang up a dry salt codfish in each pen and let them pick it when they want to. When so used there is less liability of bad habits like egg eating and feather pulling.

Fresh meat either cooked or raw is excellent when it can be had cheaply and may be fed by hanging up in pen, or run through a meat cutter and fed plain. Fresh plucks cooked and then hung up where the fowls must reach for them and only get a little at a time are excellent and to be preferred to commercial scraps.

Milk is excellent for fowls of all ages. Can be fed either sweet or sour, but should be fed either always sweet or always sour. See Chapter VIII.

Raw Food and Green Foods.—As stated in Chapter III, some live food is needed. The live cells of fresh raw green food contain an anti-scorbutic principle that is necessary to life and health. Travelers know how raw potatoes will prevent and cure scurvy. Live raw food prevents disease in poultry and helps keep them sound and vigorous. Raw potatoes, raw cabbages, beets, mangels, turnips, waste apples and carrots are all available and are necessary to keeping breeding birds in good condition.

Sprouted oats are excellent food for breeding stock and should be fed about seven days after they are first put into the sprouter or when the sprouts are from half an inch to an inch long. Don't let them get too old before feeding and don't feed them if musty. Keep the sprouting boxes clean and sweet by scalding and sunning after each lot of oats is removed.

Cut clover and cut alfalfa is good when the supply of other vegetable foods runs short, but it is not a substitute for raw food. It is best fed in a mash either dry or moist, but it may be fed plain. If to be fed plain first scald the cut hay with boiling water that has been lightly seasoned with salt. Feed warm but not hot. Five pounds of dry cut clover hay are ample for one feed for 100 fowls.

Raw vegetables should be run through a cutter and fed freely once a day if weather is very cold. If weather is mild, cut the raw vegetables into large chunks and place a day's supply in a wooden rack or a wire netting pocket where fowls can get at them readily. Feed plenty of raw vegetable food.

Raw onions and garlic, chopped fine and fed plain or in mash, are excellent and are particularly desirable if fowls have slight colds or if the droppings are soft and yellowish or brownish. Feed freely.

Mineral Foods.—Fresh green food and grains contain some mineral food, but unless the fowls are on very large range with unusual resources there may be deficiency in minerals supplied in food. Among the minerals necessary to the growth, maintenance and health of our poultry are: Chloride of sodium (common salt), carbonate, sulphate and phosphate of lime found in bone and oyster shells, silica found in sand and grits, and also various salts of potassium, sodium, iron, ammonium, magnesium and manganese. Some of the necessary mineral foods will be found in grains and grasses, some in earth, sand, bone, oyster shells and grit from the gravel pit, and some will be fed in fish and beef scrap. A box of hard coal ashes will help out the supply of mineral food.

Mineral food helps in the digestion and assimilation of other foods and in building, repairing and maintaining various tissues of the body, as well as for use in eggs and in plumage.

Where fowls are kept on close range or must be confined in very small yards the following tonic powder or tissue food will be found a valuable source of necessary mineral food, and I believe that its use helps to secure better fertility, better hatchability in eggs and better growth in chicks:

Kiln-dried bone meal	5 pounds
Pulverized oyster shell	1 pound
Potassium sulphate	1 pound
Table salt	2 pounds
Sodium phosphate	4 ounces
Sodium acetate	4 ounces
Sodium sulphate (Glaubers' salts)	4 ounces
Calcium fluoride	1 ounce
Magnesium phosphate	10 ounces
Ferric trioxide	10 ounces
Ammonium sulphate	14 ounces
Manganese dioxide	½ ounce
Silicic acid	½ ounce

Use the commercial salts obtained through your wholesale druggist, or have a manufacturing chemist put up the powder for you.

Reduce all of above ingredients to a powder and thoroughly mix. Add half a pound to 100 pounds of dry ground grain mash mixture for adult birds. Use half that quantity for chickens from two months to six months old. Where this is used scald the mash and feed it moist and crumbly.

Ordinarily free range fowls will get sufficient mineral food if supplied with crushed oyster shells, granulated dry raw bone, salt in the mash, and plenty of gravel and sand.

Notes on Feeding.—I do not claim my plan of feeding is superior to others, but simply that it gives me good results in health, vigor and eggs, besides proving labor saving. If the hoppers are built of sufficient size, it is not necessary to fill them up oftener than once a week. The fowls should be watered daily and houses kept clean. Pure, clean, fresh water in reasonably clean pails or fountains is of course essential to health.

There are many good food rations or methods of feeding that will give equally good results as the ones here recommended. If you have a plan of feeding that is giving you satisfactory returns I do not advise you to change. If for any reason you are not satisfied with your present plan, give this method a fair trial and I believe you will be pleased with the results obtained. Remember that it takes a little time for a flock to become accustomed to a different method of feeding. My birds have been used to this way of living from the shell up. Fowls that have been kept on scant rations and regular feedings may stuff themselves when first placed on a hopper system, and so get a little out of order; it takes a few months to get them straightened out and used to the new order of living.

My plan of feeding is best suited to White Plymouth Rocks, Wyandottes, Rhode Island Reds, Leghorns and the lighter breeds. Barred Plymouth Rocks, Brahmas, and Cochins while they often do well on this plan of feeding, sometimes require different treatment. This is because they are peculiarly susceptible to laying on internal fat. With such fowls a combination of dry mash hopper-fed and scratch grain fed in litter or from an automatic feeder will give better results.

A good dry mash may be made by mixing 200 pounds wheat bran, 100 pounds cornmeal, 100 pounds gluten, 100 pounds middlings and 100 pounds ground oats; add ½ pound of table salt to each 100 pounds of mash. If beef scrap is not fed separately 100 pounds of pure, sweet meat meal may be added. Feed from hopper and use one of the whole grain mixtures in litter of sand or clean straw twice daily, allowing a scant handful per bird at a feeding.

It is sometimes a good plan with exclusively hopper-fed fowls to give an occasional full feed of well-boiled grain, corn, wheat or oats.

The water in which grain is boiled should be lightly seasoned with salt.

Don't worry about the fowls getting too fat. It takes a fat hen to do well, and fowls accustomed to hopper feeding will seldom get overfat. More fowls are half starved by underfeeding and working for all they get in a deep litter than are injured or rendered overfat by hopper feeding. You can't get good hatchable eggs if you starve the hen or make her work off all her energy in scratching for food.

There is no truth in the statement, made by some writers, that hopper feeding is responsible for breeding birds getting out of condition, resulting in weak germs and poor fertility. There is not as much danger of such troubles from hopper feeding as there is from other methods. Fowls well fed on wholesome food, where the management exercises a fair amount of good, plain, common-sense, can be depended upon to give good results even though the various owners use widely different methods of feeding.

Hopper feeding as herein referred to applies to box hoppers or to automatic feeding hoppers. With the automatic feeder (or feeding hopper) there is less liability of heavy fowls overfeeding and laying on too much fat, even though of a susceptible variety, as these feeders can be so built that the amount of food fed is regulated in proportion to the exercise the fowl takes.

Exercise.—Even with open-box hoppers, where fowls are brought up on and are accustomed to the dry food plan (with occasional moist mashes for variety to supplement regular ration), there is never any danger of their gorging themselves and becoming fat and lazy. Being always used to having food before them at all times, they are not in the habit of filling up quickly or making hogs of themselves, except in rare cases. Such birds can be depended upon to take a sufficient amount of exercise daily without being forced to do so. In my opinion exercising birds has been to a large extent overdone. I have visited poultry plants where the runs are equipped with board hurdles to make the birds jump when going from one end of the run to the other, similar hurdles placed in the houses to encourage jumping, vegetable food hung at impossible heights so that the fowls are obliged to jump with stretched necks in order to get at the vegetable food, and even exercising machines placed in some of the pens. This is going to extremes.

A reasonable amount of exercise is necessary to keep fowls in health. Too much exercise is only a waste of food, money and energy. Fowls can be positively injured by too much exercise, and jumping and stretching for vegetable and meat food hung just out of reach is liable to have a serious effect upon the egg organs, with the result that

you get soft-shelled eggs or eggs which contain blood clots. I used to be an enthusiastic and ardent advocate of exercising fowls. I have learned better.

Give the fowls plenty of yard room. Allow not less than 65 or 75 square feet of yard room per bird. Let them run out of doors at all seasons of the year. If you do this and clear away a space in front of the pens for outdoor exercise when the ground is covered with snow, you need have no fear of your birds failing to take sufficient exercise, even though they are exclusively hopper fed. Where it is possible to change the litter often and to use the litter upon a clean floor, or to use clean white beach sand in place of litter, scattering scratch grain in litter is a satisfactory way of encouraging exercise, but don't make the birds work for all they get. That is a big mistake. Scratching in deep, dirty litter results in filling the house with clouds of dust that must be inhaled by the birds. This dust contains dry pulverized droppings, mold spores, disease germs and other filth, and is unhealthy. Fowls can inhale a sufficient quantity of this dust to get them seriously out of condition, create catarrhal diseases, and impair vitality. Remember that decreased vitality of the breeding stock, if you use the eggs for hatching, means chicks that will not live and thrive.

Fowls when hopper fed will be busy during the day scratching about the pen and run, dusting themselves in some convenient nook and ranging about, taking a sufficient amount of exercise for their needs. I have used clean white sand exclusively on the floors of the poultry houses in place of straw litter and like it best. Straw is too apt to be moldy and musty and so contain dangerous dust and disease germs.

The laying hen is frequently compared to the milch cow, although inaptly so. In this matter of exercise ask any farmer what will happen if milch cows are forced to exercise freely every day, and he will tell you that it will result in a falling off in milk yield. Some exercise is necessary. Too much is almost as bad as none at all. Don't go to extremes. You can exercise your fowls so much that they will put nearly all the energy contained in their food into building up and repairing stringy, tough muscle tissue and will give you very few eggs. Athletes attain very high muscular development, but they do not always succeed in producing healthy, vigorous children.

In caring for your breeding stock bear in mind that comfort for the fowls is of great importance. Keep them comfortable and they will help keep you. To be comfortable the fowls must have comfortable quarters not overcrowded, they must be well cared for and well fed, they must be kept comfortably clean and free from vermin.

Fussy, scrupulous cleanliness is not necessary, but it pays to keep things neat, in good order and reasonably clean.

Vermin.—Dust the fowls two or three times a year with good fresh ground Persian pyrethrum powder; work it into the plumage all over the bird well down to the skin. On roosts and dropping boards use once a month a lice killer like the following: Dissolve in kerosene all it will take up of crude naphtalene crystals, mix in a glass jar and put in a little more naphtalene than will dissolve. Shake before using. Apply to the roosts in the morning so that it will dry out before roosting time. Also spray this occasionally about poultry house in sprayer throwing a fine mist.

A "dust bath" is a good thing and will be enjoyed by the fowls, but do not make the common mistake of thinking that it must contain "dust." The "bath" should be a box of convenient size containing moist, sandy loam. The loam may be mixed with fine coal ashes if desired or it may be simply fine sand containing a little tobacco dust or insect powder. The loam or sand should always be a little bit moist and the fowls will much prefer it to a very dry, dusty bath. It helps in keeping down lice. Fowls affected with vermin are neither happy nor comfortable.

It pays for the attendant to keep in close touch with the flocks, to observe them well, to avoid sudden movements, loud speech and chasing the fowls about in the pens. Aim to keep the birds tame and used to gentle handling. It is no credit to the poultry keeper to have a lot of wild, easily frightened birds that run away on his approach. It is the well cared for, well fed, happy, healthy, contented breeding birds, managed for comfort, that yield the most hatchable eggs.

Diseases and Remedies.—If the flocks are properly managed and well kept there won't be much trouble from diseases and there will be little need for remedies. I don't believe in dosing and doctoring fowls, especially breeding stock. Sometimes, though, a few simple remedies early applied ward off trouble that appears through carelessness or from unavoidable causes.

It is a good plan to keep on hand an ounce or two of camphorated vaseline, a small quantity of permanganate of potassium crystals, a pint or more of creolin or some good commercial substitute for same known as saponified cresol, fluid cresol soap, or liquor cresolis compositus, and sold under a great variety of trade names.

Warm, damp weather may start chickenpox. If so bathe parts in soapy warm water, remove crusts and scabs, and after drying apply the camphorated vaseline.

In cases of frozen comb or wattles, rub frozen parts with cold

water, snow or ice until soft and of normal feel and color, then thoroughly rub in some of the camphorated vaseline.

For sudden colds and sneezing take them as soon as noticed, wash out mouth and nostrils with warm water and then rub camphorated vaseline into the nostrils and into the cleft in the roof of the mouth.

For colds that do not respond promptly to above treatment, mix one teaspoonful of creolin in a pint of soft warm water. Mix it fresh as needed. Use it in a pail or can like a tomato can and dip the head of the affected bird in the solution; repeat daily if necessary.

For looseness of bowels, green droppings or yellowish-brown droppings which turn green on exposure to the air, use a few drops of creolin in the drinking water, just enough to cloud it a little but not to turn it milky.

For canker from fighting or other cause, crush permanganate of potassium crystals to fine powder in proportion of about one grain to an ounce of powdered sugar; dust this on canker spots after removing all of the cheesy mass that comes away easily without bleeding. It may be blown on through a glass tube or straw. Use daily until surface is clean and begins to heal, then use less often.

For intestinal parasites, worms or germs, a good home remedy is to introduce into the crop, through a rubber tube attached to a hard rubber syringe, a mixture of two teaspoonfuls of turpentine and two tablespoonfuls of sweet oil. Chopped onions and garlic, fed raw, is also a help. Where there are worms noticed disinfect the droppings with a solution of creolin one gill in two gallons of soft water.

CHAPTER V.

Eggs for Hatching

IN CHOOSING EGGS for hatching, select those which are medium or average size for the fowl producing them. As a rule, very large or very small eggs should be rejected. When a hen always produces large eggs that are normal they can safely be used. Abnormally large eggs and those containing more than one yolk should be culled out. Eggs with thin, water-marked, rough, seamed or checked shells should not be saved for hatching. Those having limy excrescences on the shell should be discarded, as these lime warts are apt to break off during incubation and leave a hole in the shell that is fatal to the contained embryo. If a breeder should send you ill shaped, poor, thin-shelled eggs when you buy for hatching, instead of good, clean, normal eggs, enter a complaint direct to the seller. If he does not make good, don't trade there a second time. When you buy hatching eggs you are entitled to good, normal, sound-shelled eggs from healthy breeding stock, and should not receive cull eggs.

Sex of Eggs.—There is no known way of determining the sex of the chick by the appearance of the egg. The theory of foretelling the sex of the future chicken by the formation of the egg is centuries old. In the writings of Horace, long eggs are mentioned as certain to produce males. The position of the air cell has also been supposed to indicate the sex. Several well known writers of recent years have expressed the belief that long eggs or those having wrinkled ends would produce males and that the smooth, round ones would hatch pullets. There is absolutely no foundation for this belief, as may be easily ascertained by making a few test hatches.

Several English writers, and more than one American, attribute the control of sex chiefly to the condition of the male bird, and they apparently base their theory on good ground. Briefly, it is to the effect that when the male is full of vigor early in the season cockerels are likely to predominate in the chicks from his pen. Later in the season, as the male's strength and vigor (sexually) decreases, the

number of pullets in his progeny increases. However, when the male bird apparently remains equally healthy, strong and vigorous throughout the entire season, it is a common thing to have a majority of cockerels early in the season, while later on pullets predominate.

From the same flock, with as vigorous males as could be obtained, the writer has had nearly two-thirds cockerels early in the season, while later, in June and July hatches, from 90 to 100 pullets have been obtained from a hatch of 150 chicks. This, however, does not prove or disprove the theory, and it is highly probable that other elements, which we do not understand or appreciate, enter into the question of control of sex in the offspring. It is a well known fact that usually the generative organs of the male undergo considerable change at different seasons and the testes of the cock are usually largest and best developed at the height of the breeding season, which generally is in April.

There are many theories and methods proposed for the regulation of the sex of chicks, but thus far none seem to prove dependable when put to the test. It is a fact well known that some families are prone to produce females and others equally prone to produce males. This will apply to some breeding birds and some matings, and this may prove the true solution of the control of sex in so far as we can regulate it. If you have a male bird or a particular mating that gives you a larger percentage of the desired sex in the chicks, you will do well to continue breeding it or from the same line as long as you can successfully, and take whatever sex of chicks you get with as good grace as possible. It is not probable that anyone will discover any infallible rule for the control of the sex of future chicks, either by selection of eggs or by handling and management of the breeding stock.

Fertility of Eggs.—I am frequently asked how the fertility or non-fertility of an egg can be determined before incubation. It can't be done and keep the egg whole. If the egg shell is broken and the germinal spot on the yolk is examined, an experienced observer can say whether it is fertile or not. With the shell whole, and the egg known to be from a flock with which males are running, there is no test that will determine whether it is fertile or not until the egg has been incubated for a few days.

The fertility of eggs depends chiefly on the condition of the breeding stock, the number of females allotted to one male, the conditions under which they are kept and the food. If the breeders are in poor condition you will get many eggs that do not hatch well or that produce puny or weakling chicks.

Eggs may be fertile and yet not hatch well. This is because the germs are weak or poorly nourished, because of poorly balanced egg

food content. This may be due to debility on the part of the breeders or to poor feeding. Similar trouble results from breeding from birds forced for egg production or from a male that has too many mates and is taxed beyond his capacity. Where such conditions exist chicks will die at all stages of incubation and some for several days after exclusion. The germ may also be injured by overheating the eggs or keeping in too warm a place while saving for hatching. Less frequently trouble may result from chilling the eggs. Strongly fertile eggs from good, healthy stock will often hatch well and produce good chicks under apparently unfavorable conditions. Obviously the remedy for unproductive eggs is to use only healthy breeding stock and to keep the breeders in good condition by good food and good common sense care and management.

Gathering and Keeping Eggs.—Eggs for hatching should be gathered at frequent intervals to prevent injury. Severe chilling or frosting should be avoided. Even more dangerous than chilling is allowing the eggs to remain in the nest under hens that are becoming broody and then removing them to save for hatching. Each egg intended for incubation should be marked with the pen number where it was produced, the date, and where possible with the leg band number of the hen that laid it. This is for the purpose of identification of the chick and to ascertain the source of fertile hatchable eggs. Handle eggs carefully and avoid rough handling. A bad shaking up of eggs during handling or shipment has spoiled many a hatch.

A suitable place for storing eggs intended for hatching is necessary. Many eggs are ruined every year by neglect in this particular. The temperature of the room in which the eggs are kept should not fall below 40 degrees Fahrenheit and should not go above 60 degrees. The more even the temperature, the better for the eggs. Eggs have been ruined for hatching purposes by keeping them for a few days at a temperature of between 75 and 85 degrees. The room in which the eggs are kept should be well ventilated and should be as clean and wholesome as a well kept milk room, where the air is dry and sweet.

I do not believe in egg turning devices or wire egg carriers for keeping eggs for incubating purposes. The less handling the eggs get the better. They do not need to be turned while saving for hatching. They may be kept in ordinary egg cases in clean pasteboard fillers, but when stood on end in this manner, if kept for any length of time, the eggs do not hatch as well. If such a case is used, place the eggs large end down and leave them so.

I believe that the best plan is to place the eggs in clean boxes without regard as to the position of the eggs and to cover them with a woolen cloth or blanket to protect them against drafts and conse-

quent evaporation. In high altitudes it may be necessary to cover them with a damp blanket to prevent evaporation, but this should never be done except in very dry climates high above sea level, where mold and mustiness is unknown. Once in three or four days the eggs can be shifted to another box and the ones first put in used for hatching to avoid keeping any of them too long. Here is where the date on the shell proves a help.

Time Eggs May Be Kept.—The fresher eggs are when incubated the better. Don't keep them any longer than you are obliged to. There is no need of keeping eggs intended for incubation for a longer period than three weeks, and it is better not to keep them longer than two weeks. Under ordinary conditions, if properly cared for and kept at a temperature not below 40 degrees and not above 60 degrees, they will keep twenty-one days and still give a good hatch.

In high altitudes, or in exceedingly dry or very warm climates, eggs cannot be safely kept for longer than one week, or at most two weeks under favorable conditions.

Period of Incubation.—The length of time required for incubating even common hen eggs to successful exclusion varies more than is commonly supposed. Eggs of Bantams and some Mediterranean varieties often hatch earlier than those of the American or Asiatic varieties. Twenty-one days is, however, the accepted standard time required for hatching hen eggs.

The following table of length of period of incubation for the various kinds of fowl may be considered as practically correct. It was compiled from a variety of sources and will prove interesting for purposes of comparison:

Hens' eggs—	
Bantams and small active varieties	19 to 20 days
Large varieties	20 to 21 days
Ducks	26 to 28 days
Muscovey ducks	33 to 35 days
Geese	28 to 30 days
Turkeys	26 to 29 days
Guinea fowl	25 to 26 days

Let's Sum It Up.—Do not allow eggs to remain long in the nests in cold weather. When the temperature is ten degrees above zero or below, eggs are liable to become chilled in a short time. In such cold weather if they are intended for hatching purposes the eggs should be collected three or four times a day.

Do not allow broody hens to remain in the nests used by the layers. It does not do eggs any good to remain for several hours under a broody hen if you intend to save them for hatching purposes.

Bear in mind that incubation in a fertile egg begins several hours before the egg is laid, the first stages taking place before the shell is finished. This process continues to progress as long as the egg is exposed to the body heat of the hen. It ceases and the germ remains dormant after the egg is laid and cooled, but will begin again on exposure of the egg to a temperature of 80 degrees or more. Frequent starting and checking of the growth of the germ or embryo chick will result in an expenditure or loss of vital force that renders the egg less likely to hatch a strong, vigorous chick.

In selecting eggs for hatching choose only medium-sized eggs with good, sound shells. The shape does not matter so much as long as the egg is normal in appearance. Misshapen, deformed shells, very small or very large eggs, eggs with rough, sandy shells, lime warts or excrescences on the shells, thin and mottled-shelled eggs should not be set. Eggs intended for hatching ought to be fair-sized, clean, smooth, and should in every case be out of sound, healthy, vigorous stock. Eggs may be fertile, may hatch well and the chicks still be unfit to live because of lack of vitality. Do not forget that.

If eggs are dirty, fouled with droppings or other filth, wash them before they are placed under a hen or in an incubator. It is a good plan to wipe all eggs before they are set to remove any particles of dust or feathers which may adhere to the shell.

Eggs intended for hatching should be handled as little as possible. Put them in a cool room where the air is fresh and sweet. Place them in boxes or baskets and let them alone until they are wanted for hatching. The temperature of the room in which the eggs are kept should not be below 40 degrees nor above 60 degrees F. Prolonged exposure of the eggs to a temperature of 80 degrees F. or above is injurious. Do not turn the eggs daily while keeping them. Such handling is dangerous practice and sure to result in losses.

The reason why so many eggs sent by express turn out badly is that they are frequently heated and cooled during transit. This lowers the vitality, and even though the percentage of fertility may be good and a large number of the chicks hatch, you are liable to lose a great many of such chicks from so-called white diarrhoea. Eggs shipped any distance should be packed in cases that are well insulated with corrugated straw board and should be further protected by a packing of ground cork, cut hay or similar material that will help insulate the eggs from outside temperatures. It is common practice of express companies to leave egg cases on station platforms exposed to chilling and icy winds and then remove them to a hot express car or station waiting room where the eggs will be quickly heated up alongside a hot stove or bank of steam pipes. This frequent warming

up and cooling is what causes the trouble, and is a hundred times more dangerous than the jarring the eggs receive during the trip. At the same time shaking and jarring eggs does not do them any good.

Eggs should not be kept too long before incubating them. Three weeks is probably the maximum limit of safety. The older an egg before it is set the lower the vitality of the germ and the less likelihood there is of getting a strong chick. Preferably do not set eggs that are more than two weeks old. The fresher the egg when set the better. If possible, have all the eggs in one tray or in one machine or under one hen of very nearly the same age.

Food and water wagon used in caring for many flocks of hen-hatched, hen-reared chicks on a Little Compton, Rhode Island, egg farm. (Photo by Dr. Woods.)

CHAPTER VI.

Incubation—Natural and Artificial

THERE IS NO PRETTIER PICTURE of springtime than a proud, well set up, thoroughbred mother hen surrounded by a fine flock of sturdy, healthy, downy chicks that are well cared for. Do you, Reader, possess that kind, and if not, why not?

With proper care given to breeding for health there is probably no new-born animal that comes into the world so well equipped to live and thrive as the domestic chicken. With the eggs from sound, healthy breeding stock, and properly and normally incubated, the chick is practically born to live; nothing short of actual abuse will kill it. The normal chick possesses wonderful vitality and, given reasonably good care, it will thrive. Chicks simply need to be kept comfortable, contented and happy. With a sensible attendant to minister to their needs, by providing comfortable quarters and a supply of wholesome food, they are quickly taught to take care of themselves within a few days after they are hatched. Why, then, is it that we have so many complaints each chick season of difficulty in rearing chicks?

The answer is that comparatively few normal chicks are hatched today. For years breeding for health has been neglected. Very few breeders are sufficiently careful to give the same attention to keeping breeding fowls healthy and in good breeding condition that they would surely give to other farm animals. Stock is pushed for market or for a big egg yield, and eggs from this stock are used for hatching. Birds are conditioned for the show room, shipped long distances under trying conditions, and overshown, and are then expected to do their part in the breeding pen. In the effort to secure perfection of form and plumage, stamina is overlooked and diseased or constitutionally weak specimens are bred. To "fix" some desired standard requisite, incestuous inbreeding is practiced to an extent that would have wiped out a less naturally hardy race long ago. In the effort to get chicks in season and out of season artificial methods of incubating and brooding are resorted to by persons who have little or no ex-

perience with such machines and who, many of them, either do not read or do not understand the directions for operating. Is it any wonder that millions of chicks every year are not well born and do not thrive?

Hatching with hens is the natural method and the one that yields the most certain results in the long run. It is not practicable at all seasons and is not widely favored for large plants, although I know of several egg farms where most of the chicks are spring hatched, that grow from two to four thousand chicks each year by natural methods only. It is comparatively easy to learn to get good hatches and to raise good chicks by either natural or artificial methods, if one starts with good, fresh eggs from sound, healthy breeding stock.

How to Get Good Hatches With Hens.—There is a great difference in broody hens. Some are good sitters and mothers, others poor ones. With the poor ones you may always expect to get poor hatches, and chicks that make a poor live of it. It is always wise to choose a good-sized, quiet-dispositioned, motherly hen that is inclined to stick to her nest, and one that can be handled without developing a flurry of excitement and cackling. With a good motherly sitter selected, preferably a mature hen, provide a quiet nest with a small fenced-in run where she can exercise and feed daily. A quiet place in the barn, shed or storage room will serve, but a small individual box coop containing the nest and placed out of doors in a good run is the best place to set a hen. (See Rhode Island Brood Coop, Chapter VII.) The bottom of the nest should be filled in with earth or an inverted sod packed down into a shallow dish shape. Do not hollow out too much so that the eggs will bunch in center. Pack the earth well into the corners and dish out the center of the nest a little to make it a very shallow concave; just enough so that eggs will not roll away from under the hen and not enough so that they will not spread readily when she settles down on them. Over this spread a thin layer of clean straw or soft hay. Dust the straw with pure, fresh Dalmation or Persian insect powder (use only pure, fresh-ground Pyrethrum). Give the hen a thorough dusting with the same powder before you place her in the nest. Let her sit for a day or two on nest eggs until you are sure she will stay put, then give her as many eggs as she can cover comfortably and no more. Keep her confined on the nest by closing the front of the box with a burlap sack or slatted screen. Keep the nest dark.

Feed the hen only on whole and cracked corn, supply grit and pure water, provide a dust bath in the run for her use. Allow her to leave the nest for food, exercise and water once daily at as regular a feeding time as possible. In cold weather cover the eggs with a piece

of flannel blanket while the hen is off the nest, removing same as soon as she shows an inclination to return. Do not allow the hen to remain too long off the nest in extreme cold weather. Dust the hen again with Dalmation powder three days before the chicks are due to hatch. Do not disturb the hen or allow her off the nest at hatching time. Keep the nest dark after eggs pip until ready to take brood off. If any eggs are fouled or soiled during the hatch they should be carefully washed in luke warm water or water at about 104 degrees F.

As soon as the hatch is over remove all shells and dead eggs to give the chicks more room under the hen. Allow the chicks to remain in the nest one day after hatching and keep them quiet. Remove the little family to the brood coops at noon or in the afternoon. Do not allow too many chicks to one hen; 15 to 25 chicks are enough for a good sized Wyandotte or Plymouth Rock. Some hens will take good care of larger flocks but it is never wise or safe to try to crowd too

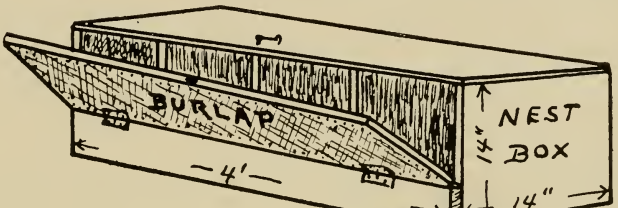


Fig. 1. Nest box for sitters. Accommodates four hens. Size 14 in. by 14 in, by 4 ft.

many chicks into one brood. Better give the hen a few less chicks than she can care for comfortably than to allow her a few too many and so lose them or perhaps spoil the whole brood.

A good nest for sitters (see Fig. 1) can be made at home, by anyone who can use tools, at small cost. This box has no bottom. The back is made of slats one inch apart, the bottom slat being five inches wide. The top is solid. Front has bottom board four inches wide and a burlap door made on a wooden frame. Dimensions of nest box: 4 ft. long, 14 in. high, 14 in. wide. It is divided into four nests to accommodate four hens. Nest sits on floor with back against wall of room used for sitters. If an earth floor is used it is well to place nest box on a piece of wire cloth and to use a wire cloth door, in place of burlap, to afford better protection from rats.

It is a good plan to set two, four or six hens at one time. Test out the eggs when they have been under the hens for a week and remove the infertile ones. Give the remaining fertile eggs to as many

of the hens as it takes to cover them comfortably and reset the other hens with a fresh lot of eggs.

H. H. Stoddard says: "There are as many methods of managing sitting hens as there are of killing cats without choking them with butter. There are a great many good ways of varying degrees of merit, and there are some mighty poor ways leading to such rage and chagrin that the advertisements of incubators are hunted up.

"Among a number of requisites the chief and most important is freedom and plenty of room to run, and run rapidly. Even if there is yard for her the maximum of good will not be afforded unless the yard is a large one, or one narrow but quite long will do. Nature teaches her to run like sixty every day and to use her wings vigorously also. Sometimes she will fly quite a distance, if of not too heavy a breed, and sometimes she has a penchant for flying up to a high perch or high place of any kind and down again. Anything to bring into play the muscles of legs and wings. There is a meaning to this. There is a close connection between the use of these muscles and the proper activity of the bowels. A proportion, and sometimes quite a large proportion, of sitters confined in cramped quarters show evidences of constipation and diarrhoea by turns, and will foul their nests.

"Have a number of yards for your stock of layers of the sitting sort, that you mean to use as sitters from time to time as they become broody. Two yards or four or a dozen or twenty, according to the scale you are operating on. Each is supposed to be ten or twelve rods square, if space can be afforded, but any way must be ten or twelve rods long in the direction the division fences run, even if only five or six rods wide. These yards are all side by side, and all alike, and each has a row of movable coops located on either side of the yard near each division fence. That is, each yard has two rows of these coops. Each coop is large enough to hold a sitter's nest, or a hen with brood, and is intended to serve either purpose as required. Every other yard has a flock of laying hens in it of a sitting breed. Every other yard is empty of fowls at the start.

"Now, note that the nests and everything else in a yard are just as in other adjoining yards each side of it. One yard is a duplicate of the next, except that one has a lot of fowls in it and the other not. As soon as a hen offers to sit she is put over the fence where she sees a yard that looks like home and a nest that looks exactly like the one she had been using, and which stands in the same position in regard to a division fence and to all other surroundings. It has some nest eggs in it. If she is worth a cent as a sitter she will take to them as a duck to water, at sundown, anyhow, if not sooner. If she does not,

then see to it that she is removed to another part of the farm and never allowed again in Sitter's Row to disgrace the profession.

"Now one little precaution. To aid layers to recognize different nest coops have some distinguishing object at each. A box, a bundle of cornstalks, or a fencepost or a board or anything, in short, that is big enough to be somewhat prominent. Have these nest coops in pairs with fence between. For instance, if a nail keg is the badge of a particular nest coop, then over the fence is another coop with a nail keg exactly like it at same side of yard, north side or west side or whatever, in the same position. Suppose the division fences run north and south and the yard occupied by a lot of fowls has prominent objects such as a roost and bower for shade at the south end of this yard. Why in the south end of the yard adjoining where the incubating is to be done have exactly such a roost and shade. The idea is, of course, to not let madam know that she is in another yard."

How to Get Good Hatches With Incubators.—In ancient times, before Christianity came to the world, artificial incubation was known and practiced in Egypt, and fireless brooders were commonly used to rear the chicks. The eggs were hatched by the wholesale in mammoth incubatories and the people from far and near, in the country about these hatching ovens, brought their eggs to be hatched or exchanged them for chicks. We have it on good authority that similar hatching ovens and similar customs prevail in Egypt today, and the chicks are said to thrive well. It isn't artificial incubation that causes the alarming chicken mortality in this country, but undoubtedly part of the losses are due to the use of poorly constructetd machines or to the unskilled use of good incubators. In Egypt the hatching is done by experts; the art of hatching eggs by artificial means has been handed down from master to apprentice for many generations. The Chinese have been adepts at artificial incubation for centuries, but with them time counts for little when learning how. With the hustling American things are different; he has confidence and is in a hurry to get there; often he appears to think it a waste of time to study directions or to take time to learn the operation of an incubator before he tries to make a business of hatching eggs with it. That he sometimes succeeds in spite of heedless haste may be attributetd to a natural aptness of the race to learn to take advantage of the lessons of experience; too often he will not take time to learn the lesson thoroughly, and it can be safely said, without fear of successful contradiction, that we have very few masters of artificial incubation in our country and a very large army of experimenters who seem more concerned with producing novelties than with practical results. Considering this, it is not remarkable that millions of chicks are ill born

and do not thrive each season. It speaks well for the vitality of our domestic fowls that so many chicks do live and thrive under conditions that would quickly exterminate less hardy animals.

But, you say, novices frequently report good results from artificial methods. Sure they do, and some of them undoubtedly get them at first, when they apply themselves sufficiently to following carefully prepared directions, but one or two successful hatches don't make an incubator expert any more than one swallow makes a summer. The best advice that can be given to beginners with incubators is to STUDY AND LEARN TO APPLY THE MANUFACTURER'S DIRECTIONS. If you cannot get good results that way, put it up to the manufacturer and do it hard. But first make sure that the fault is not your own and, no matter how you intend to hatch 'em, BE SURE TO USE ONLY GOOD FRESH EGGS, FROM SOUND, HEALTHY BREEDING STOCK.

Frequently beginners are successful at first because everything is new and clean and they are fortunate enough to have good, fresh eggs from sound, healthy breeders. Such success, however, sometimes leads to disaster later on, because it looks so easy, and then carelessness in little essentials begins the downfall. Never permit yourself to think that "you know all about poultry;" nobody on this green earth does, and "the wise are always learning."

Incubators and brooders are necessary for poultry growing on a large scale. In buying such machines try to get practical merit and simplicity of construction and operation. Beware of plausible "talking points," complicated construction, and frequently added, but not lasting, "improvements." Novelties in construction and frequent changes in same are chiefly for the purpose of "helping sales," and don't add to the efficiency of the machines. Bear in mind that artificial incubating and brooding are many centuries older than Christianity and we have not yet discovered anyone who has learned any important new facts concerning such methods. Simplicity is one of the chief essentials, both in the matter of construction and in operation. When you buy, get a machine you can understand and that the manufacturer can demonstrate in a way you can understand. Don't take too much stock in printed testimonials. They are easy to get and a well-written, well-printed one is often so good an ad for the giver that it is an inducement to have a good one circulated. The only recommendation that counts is one from someone in whom you have confidence and whom you know is successful and who makes it to you personally, exclusively for your benefit. Whoever heard of a poor servant that did not have plenty of written references? Most of 'em given because the party asked found it easier to give than to refuse.

There are plenty of good machines that will give good results when properly operated, and it pays to be sure before you buy, rather than to be sorry afterward. The best one for you is the one that is giving the most satisfactory results in your immediate neighborhood. It is difficult to produce a machine that will yield equally satisfactory results in all parts of this poultry-growing world, where so many different conditions and climatic factors enter into the problem.

Be sure to use a dependable, standard-pattern incubator. In matters of operation follow strictly the manufacturer's directions. If possible, locate the machine in a well-ventilated cellar having an earth floor. Do not run the incubator in a room or small cellar containing heating apparatus in which a coal fire is kept burning. Coal gas, where the cellar is small and ill ventilated, may prove fatal to the embryo chicks. If necessary to use such a cellar, partition off a room for the incubator and arrange so that the incubator room can have independent ventilation. This is an important precaution. It is also a wise plan to arrange some means for piping off the lamp fumes from the incubators. The imperfect combustion of burning kerosene oil by aid of a lamp wick gives off dangerous products that are poisonous to the embryo chicks in the eggs. Select eggs for use in incubators with as great care as you would if you intended to set them under hens. Use only perfectly fresh eggs that have been properly kept.

Thoroughly clean the incubator before you start a hatch. Sun and air all movable parts. After you have the machine heated up and regulating properly spray or paint the entire interior of the egg chamber with a solution of creolin (or any good commercial creolin substitute or cresol disinfectant) and water (use soft water) 6 to 12 hours before you place the eggs in the machine. Do not be afraid to get the interior of the machine wet. To make the solution add one gill of creolin to 8½ quarts of warm water and thoroughly mix. So disinfecting the machine will lessen the liability of infection from any germs that may be contained on eggs from doubtful sources, and will insure the destruction of mold spores and other germs which are commonly found in old incubators. This practice alone has resulted in a surprising reduction of the mortality of incubator chicks.

In incubator operation be careful not to allow the temperature to run too high. Prolonged and frequent exposure of the eggs to a temperature of 104 degrees F. and above has an injurious effect upon the embryo and results in a loss of vitality through over-stimulation. Such eggs may hatch and give you a large percentage of chicks, but commonly they will die off rapidly during the first two weeks in the brooder, Frequently the chicks die in the shell from exhaustion of vitality. The safest incubating temperatures are from 101½ to 102½ de-

grees during the first week, 103 degrees from the time of the first test on the seventh day until the eggs begin to pip. At pipping time and while the chicks are hatching out the temperature may be allowed to go to 104 degrees or even 105 degrees without doing harm. Too much cooling and too much ventilation in the early stages of incubation is harmful, the eggs lose moisture and the membranes toughen.

After the chicks are hatched they need all of the fresh air you can give them and at the same time keep them comfortably warm. Chicks are often injured by failure to give them a sufficient supply of fresh air after they have hatched and begun to dry off. Conditions are very different when the chick is in the egg breathing through the blood vessels which line the shell than they are after it has been excluded and begins to breathe through its lungs. While in the shell too much fresh air and a strong air current in the egg chamber is not beneficial and is sometimes even injurious through drying down the eggs too much, resulting in a loss of moisture needed by the chicks. Some incubators having a forced draft ventilating plan use moisture pans or sand trays to avoid so far as possible this drying down process.

Ordinarily it is best to operate an incubator in a room where the outside or room temperature can be maintained fairly uniform. It is not wise to run an incubator where the outside temperature is below 40 degrees or above 80 degrees F. A fairly constant temperature between 50 degrees and 60 degrees F. is almost ideal for incubator operation, provided the room has good ventilation and the lamp fumes are carried away in such a manner that they cannot enter the machine. Always provide for an abundance of fresh air in the incubator room. It is required by the lamps and also for the purpose of preventing concentrated lamp fumes entering the egg chamber. An earth floor is best; cement floors are not desirable, except as walks between rows of machines.

Eggs should be turned, preferably by hand outside of the machine, twice daily after they have been incubated 36 hours and continuing until the 18th day, at which time stop turning and let the eggs alone until they hatch. Do not turn the eggs on the day on which you test them. Do not expose eggs to a temperature below 40 degrees F. while testing. In testing at any temperature below 60 degrees F. protect the eggs both above and below by a warm flannel blanket. When testing or when cooling the eggs protect the bottom of the egg tray. If bottom of tray is exposed as well as the top the eggs cool too quickly. Try to duplicate conditions in the hen's nest.

Little chicks should remain in the incubator until about 36 hours old. With incubators that have glass doors it is well to darken the

front of the machine by hanging a heavy paper or cloth in front of the door while the eggs are hatching. The little wet chicks ought to stay on the egg tray until they are dried off. It does not do them any good to fall into the cooler nursery department before they are well dried, as they are liable to become chilled by so doing.

When the little chicks are well dried off it is a good plan to open the incubator door the width of one or two matches. Drive a tack into the front of the machine above the door and attach to this a piece of soft wire. A turn or two of the other end of the wire about the knob of the incubator door will hold same in position and open to the desired degree.

Bear in mind that too much and too frequent cooling, overheating and prolonged exposure of the eggs to a temperature of 104 degrees or above is liable to invite disaster and result in losses of the chicks, even if they do hatch well. Overheating is more dangerous than prolonged cooling. Rough handling of the eggs while turning them is also injurious. When, after testing, only a comparatively few eggs remain in the machine, place them in the center of the tray and confine them by means of small, smooth pieces of wood laid on the egg tray to prevent the eggs rolling about.

Always try to run your incubator with a lamp flame of moderate or medium height and secure as close an adjustment of the regulating device as possible. With incubators having an outside galvanized iron heater and heated by the hot air plan, the metal disc attached to the regulator arm should be adjusted to run as close as possible to the opening in the top of the heater. If allowed to run too high it requires too much superheated air to maintain the proper degree of heat in the incubator, and such condition is injurious to the embryo chicks.

Incubator operators should bear in mind that machine incubating and brooding is a purely artificial method of rearing poultry, and cannot be expected to equal or excel the natural, normal method of hatching and brooding. On poultry plants where the breeding stock has been machine hatched and brooded for several generations, there is usually something lacking in the breeding stock; and the eggs, though running a fair percentage fertile, do not possess the same vitality as those from stock back of which are many generations of hen hatched chicks.

The artificially hatched and reared stock apparently lose a trifle each succeeding generation until it becomes difficult to obtain the best results in hatching. It is a wise plan to grow a few breeders each year by purely natural methods of hen hatching and hen rearing.

Mammoth Incubators.—Within the past few years there has been

a tendency among those investigating artificial incubation to return to the methods of earlier days. Even the small hot water incubator seems to be coming back again to its own and unquestionably, in sizes from 50 eggs to 200 eggs, some lamp heated hot water incubators are doing excellent work.

Centuries ago mammoth incubators, capable of hatching thousands of eggs, were used in the Orient and these were great ovens or chambers heated by burning dung; such incubatories are to be found today in Egypt. Today we find the greatest advancement in

Fig. 1. Fresh egg before incubating.

artificial incubation represented by the coal heated hot water mammoth incubators capable of holding from 1,000 to 60,000 eggs. These machines are really a series of small individual incubators independent of one another as to filling and hatching but having system of hot water pipe or radiator heating from one or more coal burning heaters. They require a specially built cellar. Such machines still need perfecting in order to reach the maximum efficiency but there are a considerable number of them in operation that are yielding good results. In economy and ease of operation they certainly are ahead of the individual small machine and the best makes hatch quite as well or better than the large sizes of lamp heated incubators.

Some poultrymen believe that chicks hatched by hot water heat are better than those hatched by diffusion of hot air or radiation from a hot air heated drum.

How to Test Eggs During Incubation.—Eggs should be tested at least once during incubation and the infertile eggs, as well as the dead germs, removed from the machine or from under the hens. When a number of hens are set at the same time and the eggs are not running a good percentage fertile, it is often possible to save the time of the sitters by testing the eggs at the end of the first week,

Fig. 2. Dead germ or "blood streak."

giving the fertile eggs to as many hens as can cover them well and resetting the other hens with fresh eggs.

When it is difficult to get a sufficient number of sitters and there are not enough eggs to fill an incubator, the eggs on hand can be started in the incubator, tested at the end of a week and the fertile ones given to hens to hatch. This saves time and avoids the accumulation of hatching eggs that are too stale to hatch well when enough have been obtained to fill a machine. The plan works well and is popular with a number of practical poultrymen.

Infertile eggs tested out of the incubator at the end of a week are quite good for home cooking purposes and often bakers will be

glad to buy them. It is, however, necessary to test them carefully and be sure to include only clear, infertile eggs in those for cooking purposes. If sold they should be sold as infertile eggs tested out from an incubator. Tested out eggs from under hens cannot be used for cooking, as they are liable to prove strong flavored.

New incubators are supplied with egg testers by the manufacturers and these simple testers for use with lamp or other artificial light are easy to use, but most of them require a dark room. Box testers, equipped with a powerful reflector for use with lamp, gas or electric light, are excellent and do good work. Any of these can be

Fig. 3. Strong germed fertile egg on 7th day.

bought of poultry supply houses at reasonable cost. You can make a good egg tester for daylight use at home for a very small cost. All that is needed is a soft pine board about ten inches wide and long enough to fit in the window of your incubator room. Near the center of this board make two holes about one and one-half inches in diameter and four inches apart (edge to edge). About the edges of these holes tack soft felt, leather or a piece cut from the leg of an old rubber boot to make a soft pad to press the egg against when holding up to the hole in testing. With such a board, fastened in place, in a sunny window the eggs can be tested very quickly by hold-

ing them to the testing holes and viewing the egg contents by the light which shines through. A curtain can be used above the board to keep light out of the operator's eyes, but it is not necessary. I find sunlight very satisfactory when testing eggs and have had excellent results with just daylight when the sun did not shine. It is a clean, easy method and does away with hot smelly lamps.

Even if you do not want to save time and room, eggs should be tested during incubation to get rid of infertile eggs and dead germs, as it gives the remaining eggs a better chance. Testing is easily

Fig. 4. Infertile egg after 14 days' incubation.

learned and the illustrations herewith, from photographs, will prove a help to the beginner.

Figure 1 shows a fresh egg as it looks when held in front of the tester. The air cell shows at the top and the pores in the egg shell are plainly seen. The shadow of the yolk is seen a little above the center at the left. There is no way to tell, without breaking it, whether such an egg is fertile or not until it has been incubated for a few days. This was a dark shelled hen egg and was comparatively fresh.

Figure 2 shows a dead germ, "blood streak" or "broken yolk"

egg as tested out after a few days' incubation. The irregular diagonal line, running from the top at the right to deep shadow of the yolk at the lower left, is the blood streak, a bright red blood vessel and the indication that incubation started and stopped through death of embryo. Such eggs should be tested out and buried. This also was a dark shelled egg.

Figure 3 shows a good strong germed fertile egg after seven days' incubation. Note the many healthy appearing blood vessels and the considerable dark area, also the well developed air space at large end of egg. When this egg was held before the tester the embryo chick was out of sight at the right and could not be brought

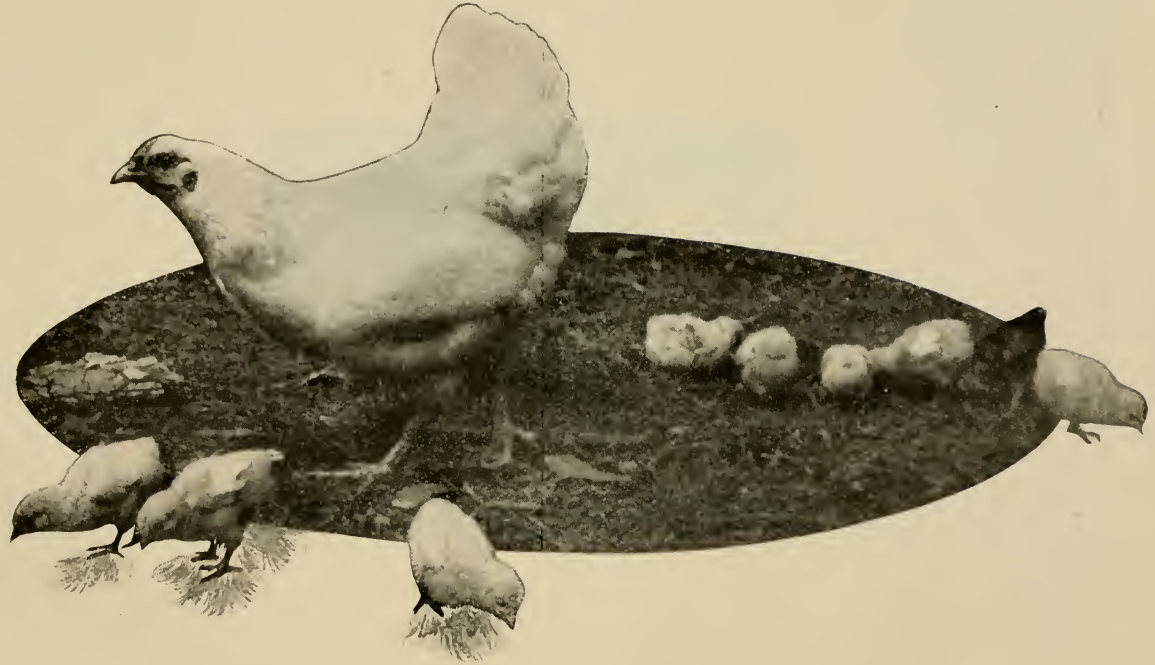
Fig. 5. Strong germed fertile egg after 14 days' incubation.

into focus. In light shelled eggs the embryo can often be plainly seen. Eggs like this will generally hatch if the balance of incubation is properly conducted.

Figure 4 is an infertile egg after fourteen days' incubation. Note the large air space in large end and the shadow of the flattened yolk above the center of the egg. This egg should have been tested out on the seventh day and used for cooking purposes; after fourteen days in the machine it was no longer fit for use.

Figure 5 is a strong germed fertile egg after two weeks' incubation. Note that the large dark area indicates that the chick and membranes nearly fill the shell, bright red blood vessels are noticed near the large end where they show above the dark mass.

Try your eggs out before the tester, using these illustrations as a guide, and after a few trials you will become sufficiently experienced to test rapidly. Any eggs about which you are in doubt can be left in the machine and tried out at the next test. Mark them for identification, using a soft pencil.



CHAPTER VII.

Brooding Chicks With Hens and Brooders

BEFORE TAKING UP ARTIFICIAL BROODING I want to say a few words about the natural method, since losses do frequently occur in hen hatched and brooded flocks. When the little chicks are about one day to 36 hours old the mother hen and her brood are ready to go to permanent brooding quarters. These should be in a comfortable brood coop, packing case, box or barrel having a slatted front, so that the hen can be confined and the little chicks permitted to run. The box or brood coop should be protected from the weather so that rain cannot beat in and make it wet and uncomfortable. It should be placed in some dry sheltered spot so that it will not be too hot for the hen mother during the warm and sunny part of the day. The brood coop should as a rule face south. Cut straw, chopped hay, clover or sand may be used to litter the floor of the brood coop. Provide sun shelters of canvas, burlap, boards or evergreen boughs in front of coop.

The hen mother should have a constant supply of corn and wheat, or good clean wheat screenings, close by the front of her coop within easy reach. A drinking fountain of pure water should also be easily accessible. The food for the little chicks should be fed on a feeding board or from a covered hopper just out of reach of the mother hen, so that she cannot waste this more expensive grain mixture. Confine the little chicks close to the mother's coop for the first few days. After they are a week old they can be given practically free range on grass land if desired. In cold weather the brood coop should be placed under shelter in an open shed or open front coop where the chicks can have an indoor fresh air run. Fine sifted, pure beef scrap and a good dry grain chick food should be kept before the little chicks from the start, giving them their first feed as soon as they are placed in the brood coop. Variety food and green food should be supplied in the same manner as for brooder chicks. Keep the chicks with their hen mother until she weans them and then put them in colony coops 25 to 50 in a flock.

Hen and Chicks.—One of the best brood coops for hen and chicks is the Rhode Island brood coop (see Fig. 2) combined with the box coop for brood hens (see Fig. 3). The Rhode Island brood coop is made of ½ inch box board stuff and has a removable floor. It is 2½ feet cube with the addition of a double pitch roof of lapped boards and it has a ventilating door above the window front; the hole is about 4 inches in diameter and is closed by a slide when desired.

In this coop is used a box coop for brood hens that will just fit into the rear half of the brood coop. This box coop is simply a cracker box with a slatted opening for chicks in one end or front (see Fig. 3). The back of this box has a hinged lid so that it can

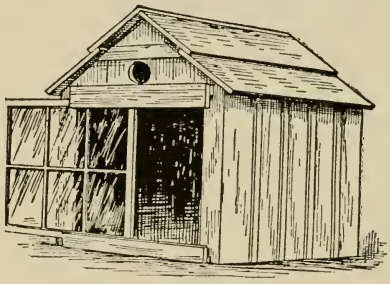


Fig. 2. Rhode Island brood coop for hen and chicks. It is 2½ feet cube with double pitch roof and is made of box boards. The floor is removable. The ventilating hole above window is 4 inches in diameter. This coop will accommodate a brood hen and twenty-five chicks. The hen does not leave the coop, but the chicks are allowed to range as soon as large enough. In cold weather and when the chicks are small, or when it is desired to set a hen in the coop, a brood box (see Fig. 3) is used in this brood coop.

be easily cleaned. This box can be used in the brood coop when hatching with hens by simply making a nest in one end of the brood box.

The brood hen is kept always confined to the brood box in cold weather and when the chicks are small. Later she is permitted to have the whole of the brood coop and the brood box is removed to give the chicks more house room. The rule is to keep the hen confined and to let the chicks run. At first they have only the run of the floor space of the brood coop that is left in front of the brood box. As they grow and need more run they are given a run outside of the brood coop and eventually have practically free range. Each hen is allowed 25 chicks.

With a battery of brood coops placed in rows in a field, about ten paces apart, it is possible for one man to comfortably care for five thousand hen brooded chicks quite as easily as he could for the same number of chicks in brooders where brooding is done during mild springlike weather. One Rhode Island breeder who uses this plan of brooding put into his rearing field in April, 1908, 864 hen-hatched chicks, 25 allotted to each brood hen in a brood coop, and in the fall he had 862 chicks well grown and ready to house, a loss of only two chicks out of 864. This remarkable record would be difficult to duplicate with any brooding system.

Where these brood coops are used out of doors in very cold weather two hens which come off together are sometimes given the same brood in one coop in order to be sure that chicks are kept more comfortable. It is necessary to make sure that you use two hens that are not inclined to be quarrelsome. With this system the

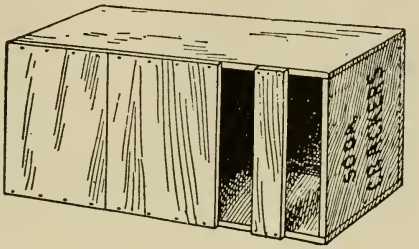


Fig. 3. Brood box for brood hens, or may be used for sitters. This box is made to fit into the rear half of the Rhode Island brood coop.

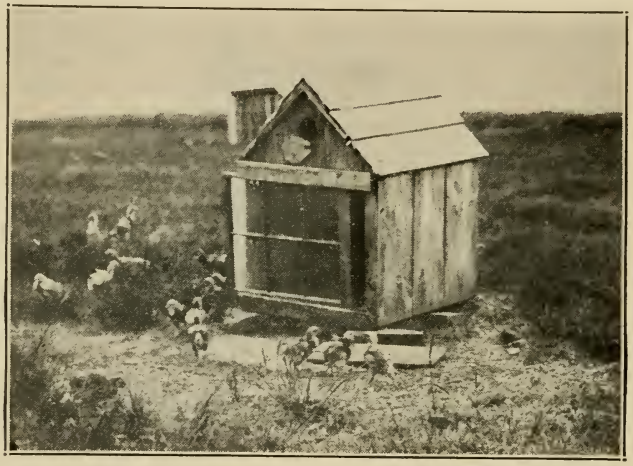
hen teaches the chicks and that is a decided advantage over artificial brooding where the operator has to play hen mother.

Brood Coop, Slatted Run and Shelter Tent.—A simple and cheaply constructed brood coop (see Fig. 4) is the apex or "A" shaped coop Make it with a removable board floor, solid back and roof and slatted front. Dimensions: 2½ feet square at base and 2½ feet high at the peak. In the illustration this coop is shown with a slatted run for hen and a shelter tent of awning duck to protect the flock against rain and sun. Another good brood coop is the Rhode Island brood coop, shown in Fig. 2. This coop is about 2½ feet wide, 2½ feet deep and 3 feet high at peak. It has a ventilator in gable. Door and front are made by a 6 light half sash, which slides in cleats. In both styles the mother hen is confined and the chicks are allowed to run.

Fig. 5 and Fig. 6 show a field of brood coops with slatted runs,

the entire field protected by a twine hawk and crow scare. I was told that it took five dollars' worth of twine to protect this plant and it was considered well worth the money. Before it was used the owner lost nearly a hundred fine chicks, taken by crows in an afternoon. After the twine was strung there were no more losses from hawks or crows. The farm is located near the edge of the woods. Common heavy white twine was used, stretched from telegraph wire and placed about five inches apart on the wire. The whole was high enough so that the attendant could walk below it to care for the chicks.

How to Brood Chicks in Brooders.—Brooder chicks, no matter



Rhode Island Brood Coop for hen with chicks. Dimensions, base 2½ ft. square, 3 ft. high at peak. Front and door of one-half sash, 6 light. (Photo by Dr. Woods.)

how hatched, if well cared for have many advantages over those that are carelessly brooded under hens, and it is possible by careful management to grow chicks in brooders, whether hatched by the artificial or natural method, and still retain the maximum amount of vitality. Careful brooding can even make up for some of the losses incurred in artificial incubation, that is, a properly brooded chick can even make up lost vigor and acquire vitality when carefully and properly brooded by either the artificial or natural method.

Probably the best type of brooder is the outdoor, three-compartment type heated on the hot air furnace principle. Such a brooder

has a constant supply of warm fresh air all of the time flowing into the space beneath the hover. Good ventilation and a constant and abundant supply of pure, warm fresh air both day and night are absolutely essential to successful brooder chick rearing. Circular hovers that occupy the center of the brooding apartment are preferable to square hovers placed at one side. The heat should be a combination of top, bottom and side heat. There should be a compartment outside of the hover of sufficient size on all sides so that the chicks can easily get out into cooler quarters whenever they endeavor to move away from the heat. In addition to this cooler apartment outside of the hover, there should be an exercise apartment warmed by the escaping surplus heat from the brooding chamber proper. Such an outdoor brooder may be run in an open front shed or in a curtain front house in the winter time, and out of doors in spring and summer weather. I have repeatedly run individual outdoor brooders entirely out of doors without shelter of any kind in the most extreme winter weather with entirely satisfactory

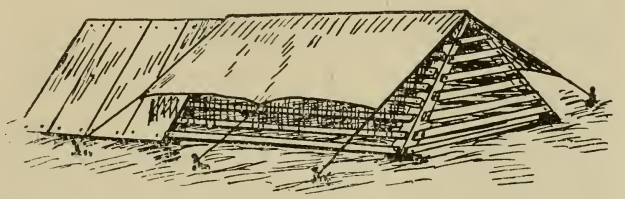


Fig. 4. Apex brood coop, slatted chick run and awning cloth shelter tent. A cheap and good home-made chick rearing equipment for hen and chicks.

results. In warm weather the brooder should be located in a sheltered or shady spot so that the direct rays of the hot summer sun will not make the interior of the brooder too hot for comfort.

Have your brooder running well, thoroughly warmed up, and maintaining a fairly even temperature before you place the chicks in it. Litter the brooder compartment well with cut clover both beneath and outside of the hover, sprinkling over it a little sand or fine grit. In three corners make a little pile of dry grain chick food and a little pile of fine, pure beef scrap on top of this clover litter close together. These should be outside of the hover. In the fourth corner place a small-sized galvanized iron drinking fountain filled with pure, fresh water. The brooder is now ready for the chicks, provided it has been running regularly for a day or two with a hover temperature of 95 degrees F. under the hover. No

matter what the brooder manufacturer tells you, do not place more than 50 chicks in any 3x3 foot or 3x6 foot brooder. That is the maximum limit of safety.

Never place any weaklings or puny chicks in the brooder. They should be promptly killed, as their presence in the flock only invites bad habits and through this results in losses. Be sure to carry a flame on your brooder lamp or stove large enough to maintain the proper temperature under the hover without the necessity of keeping the ventilators closed too much. The ventilator slides should be kept partly open all of the time to insure a good circulation of pure air. When the little chicks are put under the hover the tem-

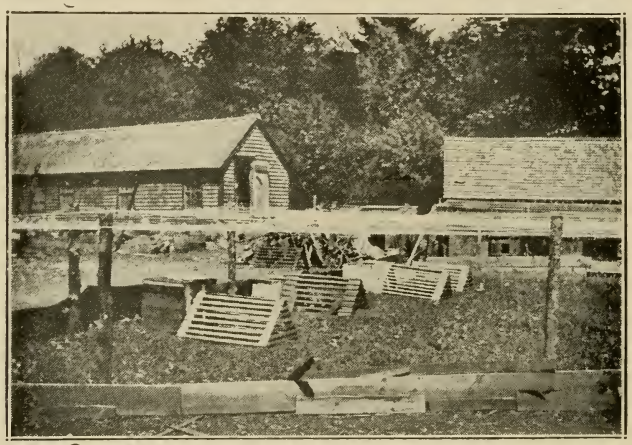


Fig. 5. Box brood coops and slatted runs for hens with chicks, the whole yard protected by a twine hawk and crow scare like that shown in Fig. 6. (Photo by Dr. Woods.)

perature will go up five or ten degrees and no attempt should be made to lower it, as you want a hover temperature of 95 degrees with no chicks under the hover. The warmth from the bodies of the little chicks causes the rise in temperature and you do not want to decrease the lamp heat on this account.

Watch your little brood and be governed in brooder operation more by the comfort of the chicks themselves than by the temperature indicated by the thermometer. I start my broods at a temperature ranging from 105 degrees to 115 degrees when the chicks are under the hover in cold weather, and from 95 degrees to 105 degrees in mild weather, paying more attention to the comfort of the chicks

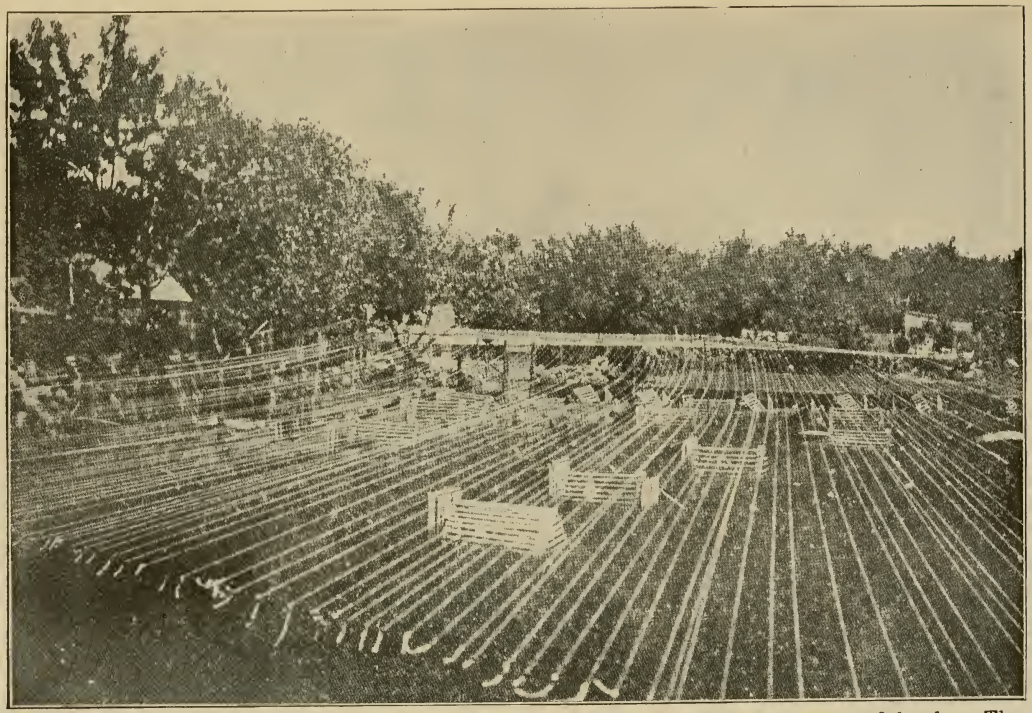


Fig. 6. A Massachusetts farmer's plan for preventing losses of chicks from crows and hawks. The whole chicken growing field is strung with bundle twine supported by several lengths of telegraph wire, and the whole high enough to permit the attendant to walk beneath it. This scheme cost about five dollars for twine and a day's labor, and was considered a profitable investment because it put an end to chicken thieving by daring crows, which were causing heavy losses.

than to the reading of the thermometer, but making sure that they are abundantly supplied with fresh air at all times.

Home-Made Brooder.—One of the simplest, oldest and best home-made brooders for use with lamp heat can be made at very small cost by using box boards. For the base two pieces of board 9 inches wide by 2 feet 10 inches and two pieces 9 inches wide by 3 feet are required. These are nailed together to make the frame of the

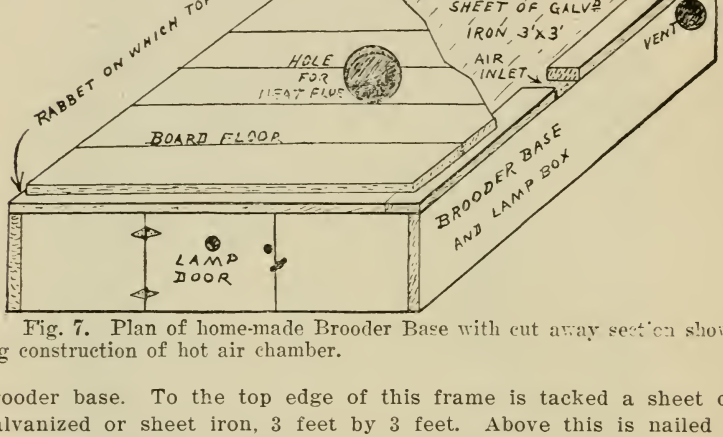


Fig. 7. Plan of home-made Brooder Base with cut away section showing construction of hot air chamber.

brooder base. To the top edge of this frame is tacked a sheet of galvanized or sheet iron, 3 feet by 3 feet. Above this is nailed a frame of 1 inch by 3 inch stuff, an opening being left on one side 3 inches wide for an air inlet. On top of this frame is built the floor, 2 feet 10 inches square, of matched boards. A 5-inch hole for the heat flue is cut in the middle of this floor. This construction leaves a rabbet 1 inch wide around the edge of the brooder, on which the top fits. (See Fig. 7.)

A tin peach can with both ends melted off is used for a heat flue, or a galvanized pipe 5 inches in diameter and 5 inches long may be used. This is nailed in place in the hole in middle of floor. A cone of the same material, 3½ inches in diameter at base, is hung by wire hooks in upper part of heat flue to serve as a heat spreader. This cone is kept filled with moist sand. Section view Fig. 8 shows detail of brooder construction and also the chimneyless burner lamp. Hover is circular and is 2 feet in diameter and has four legs 5 inches long, and a fringe of felt (double) 4½ inches long around the edge.

Complete brooder is shown in Fig. 9. The lids are used only

when brooder is used out of doors and are removable. There is a window 5 inches by 14 inches in each side and a 3-inch ventilating hole at the peak of each side. Ventilating holes are provided with slides. Front has a glass window 5 inches by 16 inches and a door 7 inches by 12 inches. For details of construction of top and lids see Figs. 8 and 9.

The brooder top is simply a four-sided board frame made to fit the rabbet around edge of floor and is fitted with removable lids, which form the roof. This top is 9 inches above the floor front and back and 13 inches at peak.

Lamp vent in base is a 2½ inch hole and is protected on the inside by a wind shield made by nailing half-inch cleats above and below the hole and tacking over these a sheet of tin. A piece of mica is fastened over the opening in the lamp door located in the

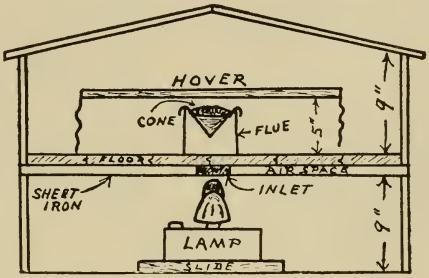


Fig. 8. Section view of home-made brooder.

rear end of brooder base. Brooders of this type have been in successful use in New England for thirty years or more. Some poultrymen run them in open sheds without any brooder top, and when more heat is needed a second lamp is added under the sheet iron floor.

In operation the heat is regulated by the height of the lamp flame, always aiming to have it warm enough under the hover so that the chicks will stay near the edge with heads peeping out from under the felts. Thermometers are used when starting the brooder and before chicks are placed in it the space beneath the hover is warmed to 95 or 100 degrees. After that the thermometer is not used and the operator keeps the hover warm enough to drive the chicks away from the center flue to the felts at the hover edge. Center flue has a band of heavy felt about it to keep chicks away from hot metal. The comfort of the chicks is the best guide to the

right amount of heat needed. Floor or brooder is kept covered with clean sand and some cut clover or hay-mow chaff. If the brooder is to be run under a shelter the best plan is to use the sides of top without the lids. In place of lids use a wooden frame covered with wire screen and cotton cloth.

Cheese Box Fireless Brooder.—Probably the first fireless brooder was made of mud and straw, rounded in the form of a small hut and baked dry in the sun, for fireless brooders were undoubtedly the first used for artificial chick rearing, and that dates back several hundred years B. C. Today we have many styles and shapes of fireless brooders made of wood and metal, all of which possess more or less

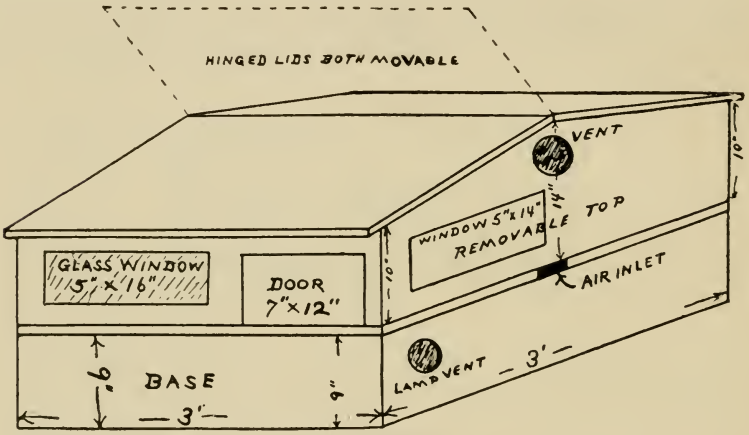


Fig. 9. Home-made Brooder complete.

merit. For the best results the fireless brooder is a mild or warm weather brooder. When it is used instead of a heated brooder, considerably more labor is required to properly care for the chicks, and, during the first ten days, almost constant attention is needed. If one has sufficient patience and the time to fuss with them, fireless brooders will raise good chicks. Some poultrymen, who raise from one to three hundred chicks, like this style of brooder very much for spring and summer use and say that they would not return to the lamp-heated type.

One of the cheapest fireless brooders is that made from a cheese box, and it is quite as good as any. Usually the box can be had for the asking from the corner grocery; the lid is not used. Fig. 10 shows the cheese box brooder complete, with hover and quilt. Two

3-inch holes, rounded at the top, are cut in the sides for the chicks to run in and out. These are made close to the floor of the box. A ring of telegraph wire is made to fit inside of the box and is covered with coarse cotton cloth to make the hover. This cloth is put on loosely with a wide lap and when in place bags down in the center to touch the brooder floor when hover is in position. Three wire nails are placed equal distances apart on inside of box, three inches from floor, and on these the hover rings rests. When the chicks go under the hover the cloth rests on their backs.

The "quilt" is the only additional protection for this brooder and is made of two circular pieces of cotton cloth or cheese cloth, with

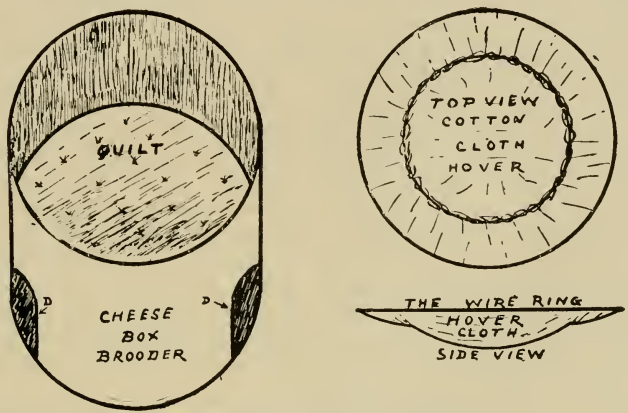


Fig. 10. Cheese-box Fireless Brooder and parts.

a loosely laid layer of wool or cotton batting, one inch thick, placed between the cloths and the whole tufted as one would tuft a quilt. This rests on top of the cotton cloth hover. Don't make the quilt too heavy or too thick, as in a large measure the brooder is ventilated through the quilt and cotton hover. It is used simply to retain a sufficient amount of the animal heat of the chicks to keep them comfortable.

In operation this brooder is run in a box 2½ feet wide by 4 feet long and high enough to take in the cheese box and leave a little room above it. The brooder half of the box has a cotton cloth cover and the other one of wire netting. From 25 to 50 chicks are started in one of these brooders, the larger flocks when the weather is cool and smaller in warm weather. The bottom of brooder is littered with cut hay about one inch deep. At night, and when resting or

warming up during the day, the chicks are confined in the cheese box by stuffing the holes in the sides with loose hay. This permits sufficient ventilation and holds the heat. At first a horseshoe-shaped yard of metal or pasteboard, the ends of which fit against the outer edges of the holes "d, d," (Fig. 10) is used to confine the chicks close to the brooder for a few days until they learn to use it. With a yard of this shape the chicks cannot huddle or crowd in corners, as the only corners in the yard open directly into the space beneath the hover, and any crowding or pushing lands them inside the brooder beneath the hover. It requires a good deal of care and attention the first week to see that the chicks do not stay outside too long and to teach them to go inside the box to warm up.

Details of Heated Brooder Operation.—Locate your outdoor heated brooders on level ground in the shade of a tree or under shelter if possible. Use wire chick runs in front. Face all brooders south. Have them level and see that they fit down to the ground on all sides. Bank up on the outside one inch with earth all around. Have a mound of earth and sod reaching up to the chick door to make a little hill for chicks to climb up and down if your brooder is one that has the floor of the exercise apartment above ground level. Do not use a board or other runway; an earth incline is the only safe plan. Make your wire run in front of brooder so that the ends converge toward the mound in such a manner that the chick door of the brooder is at the apex of the triangle so formed. If you do this, when the chicks want to get in or get scared they have to go into the brooder because that is the only place where they can stop when they get started for that end of the run.

Have your brooders ready and running properly a day or so before the chicks are hatched. Outdoor brooders are a lot of bother, but chick raising cannot be successfully accomplished without some work of a fussy nature. For flocks of 1,000 chicks or under I prefer the individual outdoor brooders. Bigger flocks on large plants require the hot water pipe house brooding system, the operation of which is an art that has to be learned by experience. The same general, practical, commonsense principles apply in brooder house operation that are necessary in the management of individual brooders. Running individual brooders out of doors is disagreeable work in bad weather. You will have to put up with sprawling in the mud and wet unless you erect a shelter over each brooder, which is a great help toward keeping your disposition sweet in chick time. I have been down on my knees in snow water and even laid down in it many a time, with a stream of ice cold water from my hat brim trickling down between my collar and neck, when operating brooders

out of doors in winter time. The man who enjoys and is busy with chick rearing will not have much time to fuss or worry about slight inconveniences of this sort.

The temperature under hover should be at 95 degrees F. with hover empty. Put chicks into brooder in afternoon. Have brooder well littered with fine cut clover or with clean hay mow chaff or sweepings. Put in a little chick grit and clean sand to barely weight down the clover. (I don't like alfalfa for brooder litter if I can get anything else and I prefer cut clover or hay mow chaff if clean and sweet.) Take out the hover when you put the chicks in and scatter dry grain chick food on the litter besides making two or three little piles of chick food and beef scrap in the corners of the brooding apartment. Tapping on the floor of the brooder with your finger near the piles of food will usually start the chicks feeding. When you have put all the chicks in and let them have a chance at the food, put on the hover. Raise one or two tabs of the felt curtain and tack them to top of hover to leave a small opening in the felts for a door. These tabs should be let down at night. Tuck the chicks in under the hover and close the brooder. Keep the entrance to the exercise apartment closed. Be sure that the cold air tube or fresh air inlet into space between iron ceiling or lamp chamber and wood floor of brooding chamber is kept open all the time. This is your cold-air box of your furnace principle and upon this inlet of fresh air depends the supply of warm air to keep the chicks comfortable. If your brooder has ventilating holes covered with galvanized iron slides at the highest point of the sides of the brooder near the roof, run these vents wide open on sunny or still days even in cold weather. In mild weather they should be kept open all the time. On windy days or at night in cold weather one of these vents on the windward side of the brooder may be closed. The other should be left wholly or half open according to the weather. Never close the vent more than one-half, even if the outside temperature goes down to 15 or 20 degrees below zero. You cannot heat and ventilate a brooder properly if these ventilating slides are wholly closed.

Watch the chicks very closely the first two weeks. You have to represent the natural hen mother and teach them all they must know during this early infancy period. After two weeks, if they are properly trained, the chicks ought to take care of themselves on all ordinary occasions. Keep them moving. Never permit them to huddle or crowd in the sun or elsewhere. If they form this habit of huddling they are in a bad way and losses will be heavy.

The first two days keep the chicks confined in the brooder apartment around the hover and tuck them under the hover frequently.

Keep pure water, grit, chick food and pure willow charcoal, with a supply of fine sifted, pure beef scrap and granulated raw bone, always before them. Scatter a little dry grain chick food in their litter once in three hours and remove the hover for a few minutes to get all of the chicks out for a chance at the food. Also keep chick food before the chicks all the time in a shallow box or pan.

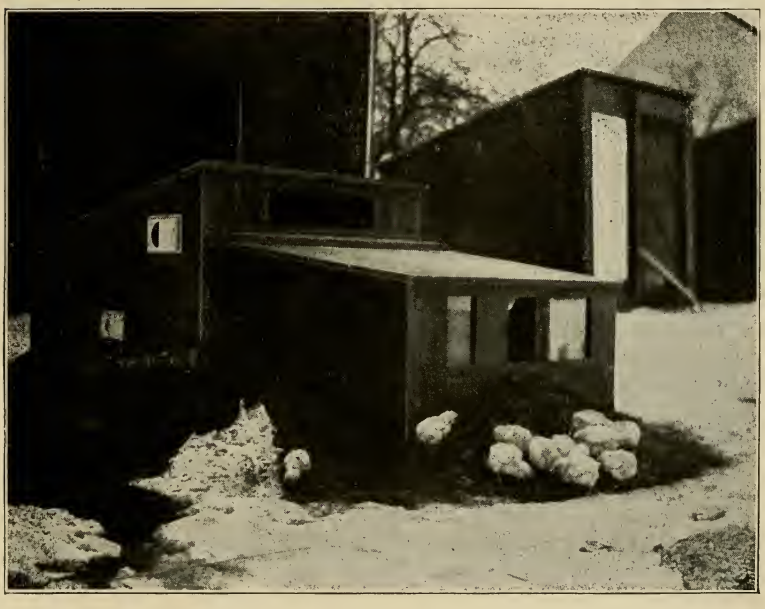
Air and sun the interior of the brooder often. From the first

View of an outdoor brooder with flock of chicks on Dr. Woods' farm. The picture was taken on the 21st of February, 1905, temperature 18 degrees above zero. Brooder was easily operated out of doors, although outdoor temperature frequently fell to zero and below. The chicks made remarkably fine growth, had well developed bodies and nice big strong legs. (Photo by Dr. Woods.)

the hover should always be removed for a short space of time during your visits to the brooders, taking care to expose the under side of the hover for a short time to the sunlight whenever possible. Never leave brooders while open or with hover out when chicks are under ten days old. Stay near by the brooder until you have closed them or replaced the hover. On warm days the brooder

lids or large doors may be left open, but do not leave them so for long at a time except in summer when they may be run open most of the time on sunny days. Put the chicks under the hover and close the brooder at the first sign of huddling or crowding. If the chicks cry a great deal there is something wrong. Look for it! They should be busy, happy and contented, making only a happy little chirp as they scratch for their food.

Run the hover space with the hover empty at about 95 degrees



View of an outdoor brooder with flock of chicks on Dr. Woods' farm. The picture was taken on the 21st of February, 1905, temperature 18 degrees above zero. Brooder was easily operated out of doors, although outdoor temperature frequently fell to zero and below. The chicks made remarkably fine growth, had well developed bodies and nice big strong legs. (Photo by Dr. Woods.)

F. the first week, then gradually drop to 90 degrees by the end of the second week and to 85 degrees by the time the chicks are a month old, but always pay more attention to the comfort of the chicks than you do to the temperature indicated by your brooder thermometer. Some flocks require more heat than others and you

should aim at all times to keep the chicks comfortable. A little extra heat, 105 degrees to even 115 degrees F. with all the chicks under the hover, will not hurt them if they have an opportunity to get away from the heat, on all sides of a circular hover, when they desire to do so. Chilling the chicks may prove fatal and is a common cause of diarrhœa.

At night if your chicks appear comfortable and are spread about the edge of the hover with their heads out from beneath the felt, do not attempt to lower the temperature by changing the height of the lamp flame, even though the thermometer registers from 100 degrees to 110 degrees, or on a cold night is as high as 115 degrees. It is always better to have a surplus of heat than not enough. Bear in mind also that chicks can stand a great deal more heat in cold, blustery weather than they can when the weather is warm and muggy.

By the third day let the chicks out into the exercise apartment. If the brooding chamber and exercise apartment are separated by a felt curtain, pin up one of the tabs to make an open door. Let them run for a little while only, then drive them back and shut them in. Repeat this often. Keep the food and water in the exercise apartment after they begin to make use of this part of the brooder.

Usually by the fifth day it will be safe to let the chicks have the use of the exercise apartment at all times. After they become used to running in and out, the felt tab which was raised should be lowered. Be sure that all your chicks are under the hover at bedtime or are comfortably spread out with their heads peeping from beneath the felts.

If at any time after dark you visit the brooder and find the chicks are all in under the felts out of sight, you can be certain that there is not a sufficient supply of surplus heat to last the chicks until morning, and with a falling outside temperature unless you increase the lamp heat the chicks are almost certain to be chilled.

When chicks are from seven days to two weeks old, according to the weather conditions and the development of the little chicks, begin to give a small run outside the brooder. By this I mean give them an outdoor run summer or winter. In cold weather let them run on frozen ground. If there is snow, clear a space in front of the brooder for an outdoor run. Get them outdoors for a few minutes daily even if you have to sprinkle chaff, hay or straw on top of the snow to encourage them to run out. In a short time they will be eager for their outdoor play and will run about on the snow and ice, growing strong and sturdy with large-boned, sound, healthy bodies and big, strong legs. A good healthy chick always has large

legs, well filled out in proportion to its size. If your little birds have thin, shrunken legs they will bear watching and need better care. Small, wizened legs are a danger signal, they mean low vitality and trouble ahead. Let them out for only a little while at first, then drive them back again just as you taught them to use the exercise apartment. In a few days they can have the freedom of the run which may be increased in size daily. They will then be smart enough to look out for themselves. You must, however, teach them well at first to avoid trouble later.

Change your brooders to new fresh ground once a month and always run the brooder on fresh ground for a new flock. Keep your chicks in the same brooder until they are weaned. Clean the brooder every week and clean the run every few days. When chicks are five to six weeks old, if possible, let them have practically free range on grass land where there is shade and shelter. Chicks may be weaned when from six to eight weeks old if they are well fledged. A good deal depends upon the size of the chicks and the condition of their plumage. Some will be ready to go to the colony coops when six weeks old, others not until they are are eight to nine weeks old. Don't take a lot of naked chicks away from heat in cold weather.

The chief secret in little chick raising is in getting them started right. You will find that, as a rule, cold weather broods are easier to teach and require less patience than hot weather broods. Never permit little chicks to huddle or crowd outside the brooder in the sunshine. If you do allow them to acquire this bad habit you will find them chilled or dead in that same spot on some cold, stormy day.

A practical outdoor brooder, with chick run and shelter attached. The husky little early chicks have been let out of shelter to get the newly started first green grass of springtime. (Photo by Dr. Woods.)

CHAPTER VIII.

Chick Foods and Feeding Chicks

USE GOOD FOOD if you want to grow good chicks. There are a number of rations that will grow good chicks if the chicks are born with plenty of vitality,—the power to live.

Corn meal dough, johnny-cake, oat meal, cracked wheat, corn grits and some commercial chick foods have all been used to grow good chicks and when sweet and wholesome, with some supplementary food used for variety and plenty of fresh succulent green food and abundance of worms and insects available, will yield good results. For general use I prefer to feed a good mixed chick food, one that is fresh ground from sound sweet grains.

Chick Foods.—The best chick food I have ever used and the one I prefer to all others is a home-made chick food ground in a common iron grinding mill, having steel burrs, and freshly made at home as needed. Small grinding mills in small sizes cost from $5 to $8 each and a larger size for power can be had as low as $25. Such mills are mighty handy to have, even on a small poultry plant, will last almost a lifetime and are no harder to run than a coffee mill of the same size. A second hand coffee mill, if the burrs are not too badly worn, will do the work well and can usually be had cheap. The following formula will make an excellent chick food:

Sound, hard, yellow corn.....4 measures
Sound, whole wheat.....3 measures
Heavy, clipped, white oats.....2 measures
Sound, heavy barley.....1 measure

Mix and grind together into a chick food that will be about as coarse as ground coffee. This mixture when ground will contain a considerable amount of fine meal. If the chicks are trough or hopper fed the meal need not be sifted out and the chicks will eat it readily. If chick food is wanted for litter feeding or to use in an automatic feeder it is better to sift out the meal so that it will not be wasted. This can be easily done when grinding by fitting a sieve made of

mosquito netting at a fairly sharp incline from the outlet of the mill and placing one box at the end of the sieve and another beneath the sieve. The food sifts itself as it runs down the inclined screen. Meal so sifted out can be hopper fed to chicks after mixing it with an equal bulk of wheat bran. Do not grind more than a week's supply at one time as it makes a better food when freshly ground. (See formula for home made chick food under "Feeding the Chicks," page 94 in this chapter.)

Another good chick food that can be mixed at home is the following:

Corn grits, or sifted fine cracked corn	45	pounds
Clean, sound cracked wheat	20	pounds
Steel-cut oat meal, "C' grade	20	pounds
Cracked barley, hulls sifted out	12½	pounds
Chick size poultry charcoal	½	pound
Granulated, dry, raw bone	1	pound
Coarse sand or chick size grit	1	pound

Just a few words about commercial chick foods. There are a number of excellent chick foods on the market, but most of them contain too much millet. If you can get the chick food without millet you will have a much better food for every day use. Chicks like millet and a very little of it may do no harm but too much of it is likely to prove injurious and causes indigestion, bowel trouble and loss of chicks. Some kinds of so-called millet found in some commercial foods are not relished by the chicks and if eaten cause indigestion. Dangerous weed seeds and other products of cheap screenings are frequently found in chick foods and these are not only unfit for feeding but usually result in starting a crop of many foul weeds all over the land used for growing the chicks.

Care should be taken in buying even the best chick foods to make sure that you obtain a fresh-made, pure, sweet article that is free from mouldy or musty grain. Cracked grain loses something in feeding value as it ages and it is more liable to spoil than whole grain. Never use any chick food that smells musty or mouldy or that has been stored in a warehouse for from six months to a year. Buy only freshly prepared chick food that is sweet, clean and bright. Insist on seeing a sample before buying and do not accept goods that are not equal to sample in quality. Cheap, spoiled, old or damaged food may kill your chicks. Don't take any chances with poor food.

Growing Foods.—Chick food must be supplemented with other foods and as the chicks grow it should gradually give way to some sort of growing food. Generally by the time chicks are from three

weeks to one month old they will do very well on any good ration suitable for laying fowl if cracked corn is substituted for whole corn. A good growing food which can be used to gradually take the place of chick food is the following:

Sifted cracked corn	40 pounds
Whole wheat (red or amber)	30 pounds
Kafir corn	10 pounds
Clean wheat screenings	10 pounds
Hulled oats	10 pounds

In addition to the above an excellent dry mash mixture for growing chicks is the following:

Whole corn	50 pounds
Whole wheat	18 pounds
Heavy white oats	16 pounds
Heavy barley	16 pounds

Mix all together and have your miller grind them to flour fineness. Use only sound sweet grains. Keep the ground mixture before chicks in same manner as any dry mash fed from a hopper. Add one-half pound of table salt to 100 pounds of the ground mixture and mix in thoroughly.

Forcing Food Mash.—For market chicks after they are six weeks old, in addition to their cracked corn and green food, the following forcing mash is excellent. It may be fed dry if desired but best and quickest results are to be had by mixing it into a crumbly moist mash with skim milk or cold water. Here is the formula:

Best yellow corn meal	50 pounds
Low grade wheat flour	10 pounds
Wheat bran	20 pounds
*First quality clover or alfalfa meal	10 pounds
Best meat meal or blood meal	10 pounds
Best fish scrap	10 pounds

*If chickens are running on a green range or can have plenty of raw green food, omit the clover or alfalfa meal. If there is any looseness of the bowels reduce the amount of beef scrap and increase the quantity of low grade flour. Add one-half pound of table salt to the 100 pounds of ground grain mixture and mix in thoroughly.

Animal Foods.—The best animal foods for growing chicks are the worms, bugs, grasshoppers and other insects that they get on open range.

Fresh fish, well scalded or boiled before feeding is an excellent form of animal food for chicks of all ages and it has the great advantage of being easily digested. It rarely causes indigestion or diarrhœa, even when too freely fed. Use only good fresh fish. Spoiled

fish is dangerous and if fed may cause losses. Nothing will make chicks grow and develop bone and muscle like well-scalded fresh fish, fed bones and all, either in a mash or plain. I fed my White Plymouth Rock chickens quantities of yellow perch, chubs, herring and other easily obtained cheap fish during spring of 1911 with excellent results; they cleaned them up, bones and all.

Fish scrap, if made from fresh wholesome fish, is an excellent addition to mashes, but it is difficult to obtain a dependable supply of desirable quality. It contains a large proportion of fish bone. This fish scrap is a by-product in manufacture of fish glue. Don't buy much fish scrap at a time and test it well before you feed much of it.

Meat, either fresh and raw or cooked, is a good food to feed sparingly to chicks.

Beef scrap, meat meal, blood meal and other similar prepared meat foods will serve as substitutes for insect life but you must be careful to get a good quality. See remarks on beef scrap in Chapter IV. Feed sparingly to chicks at first if you have not used the scrap before. It is always well to go slow at first with a new lot.

Sweet milk is excellent for small chicks of all ages. It should be given in fountains that will not permit the chicks to get themselves all smeared up with the milk. Give milk for drinking purposes in earthen founts, give only a small amount at a time and keep the fountain clean. If the milk "scours" the chicks, it should be scalded before feeding and given less frequently. Use sweet milk for mixing moist mashes when it can be had cheaply.

Sour milk is a good drink for weaned chicks and adult stock. I do not like it for small chicks. Where both sweet and sour milk are to be used, don't alternate them. Either feed the milk always sweet or always sour. Feeding sweet milk at one time and sour milk another is apt to start troublesome diarrhœa. The best way to use sour milk for young chicks is to heat it until the curd separates from the whey. Salt the curd just a little and squeeze it dry; the cheese so made is excellent for chicks of all ages. I sometimes add a little black pepper to the curd cheese.

Scalded sweet milk thickened with boiled bread flour, and seasoned lightly with nutmeg and ginger, is excellent for small chicks to remedy diarrhœal troubles.

Eggs are good for small chicks but should not be fed too freely. The white of a fresh egg stirred up raw with a little scalded milk, cooled before mixing, will help in cases of diarrhœa. Infertile, tested out, eggs should be hard boiled before feeding to chicks. Keep such eggs at the boiling point for fully ten minutes.

Green Foods.—For small chicks there is nothing better as a source of green food supply than a good grass or clover range. Clippings from oat sprouts are excellent. Fresh cut, ¼-inch lengths of lawn grass, and white or red clover leaves are good. Raw potatoes, cut in chunks for chicks to pick at or ground fine in a vegetable chopper are fine vegetable food for young chicks at any age. Cabbage, lettuce, onions and other raw greens are all good when properly fed. Live raw food is necessary to health and growth.

Fresh cut, finely chopped dandelion leaves are excellent green food for young chicks, especially where there is any tendency to diarrhœa. Dandelions may be fed freely.

Other variety and supplementary foods for small chicks will be taken up under feeding.

Mineral Foods for Small Chicks.—Little chicks as well as fowls need more mineral food than they get in grains, grasses and animal foods that are fed. If they get an outdoor run where they can eat earth, sand and gravel and are supplied with fine oyster shells, a good gravel grit, and kiln dried granulated raw bone they will generally get along very well. See under heading "Mineral Foods" in Chapter VI and the white diarrhœa remedy in Chapter X. Hard coal ashes are good for chicks.

Feeding the Chicks.—Small chickens are creatures of habit. You cannot be too careful how you feed and train them at the start. If they are permitted to begin eating too much sand, grit, paper and felt or acquire other similar bad habits, you will find it almost impossible to break them of it. For this reason be careful to teach them to eat only wholesome food at the start.

With hen-hatched, hen-brooded chicks you will not have much trouble getting them started right if you confine the hen and let the chicks run outside her coop, gradually giving them more range as they need it. Simply supply the hen with her ration, and drinking water where she can reach it, and place the food for the chicks just out of her reach after the first few days. For the first day or two you should let her have the chick food where she can call the chicks to eat it; after she has them started right don't waste chick food by feeding it to the mother hen, give her whole corn and wheat.

With brooder chicks have the floor of the brooder well littered with cut clover or hay mow chaff. On this sprinkle a little coarse sand or chick size grit. Provide a drinking fountain containing fresh water. Make a small pile of chick food and another of beef scrap in each corner of brooder, except that occupied by drinking fountain.

Chicks will not be ready to be fed until they have had rest and

warmth for some hours after hatching. Usually they will begin to cry for food when they are from twenty-four to thirty-six hours out of the shell. When the "hungry cry" becomes insistent the chicks are ready to go to brooder or brood coop. It is well to give each chick a drink of water by dipping its bill before you place it in brood coop or brooder. Attract attention of brooder chicks to their food by tapping finger on floor near the small piles of food. See detail of care for first week in Chapter VII.

Try to keep the chicks comfortable, contented and happy; that is the secret of successful chick rearing, and to learn how one needs to study and understand the chicks. They need to be kept comfortably warm, clean and well supplied with fresh air. They require a variety of wholesome food and a constant supply of pure drinking water, grit, dry granulated bone or bone meal, and charcoal. They should be given an opportunity to exercise, and for this purpose a well sanded floor covered with cut clover hay is the best. Alfalfa will serve if it is not too dusty, but I don't like the average very dusty commercial article for small chicks. Feed a little of the chick food and a small amount of beef scrap daily in this litter to encourage exercise.

A good home-made chick food for starting baby chicks, and one that has always given good results, can be ground in any iron coffee mill and made fresh as needed. Cracked or ground grain loses some in value if kept overlong, and if kept in a damp place or during hot, humid weather, spoils quickly. The formula for this chick food is equal parts by measure corn, barley and wheat, ground to a very coarse meal and to which is added one part of rolled oats. For the first week alternated with a little oven-dried bread or cracker crumbs, rubbed up with hard-boiled egg, this food gives excellent results. After the first week grind it a little coarser and add some chick size corn grits. Commercial chick food may be fed to supplement the ration, but preferably should be free from millet. Feed scrap in the litter at first and afterwards mix with wheat bran and feed from a box hopper.

The dry grain chick food ration should be supplemented by occasional feedings of cooked wheat or cracked rice. The wheat or rice should be thoroughly well boiled in water lightly seasoned with salt, taking care not to mash the grains up too much. Cook until thoroughly soft and most of the water is evaporated. This cooked grain may be fed slightly warm or cold and is greatly relished as a supplementary or variety food. Sprinkle a little raw bone meal or granulated raw bone over this cooked food just before feeding. Feed one meal two or three times a week until the chicks are well started.

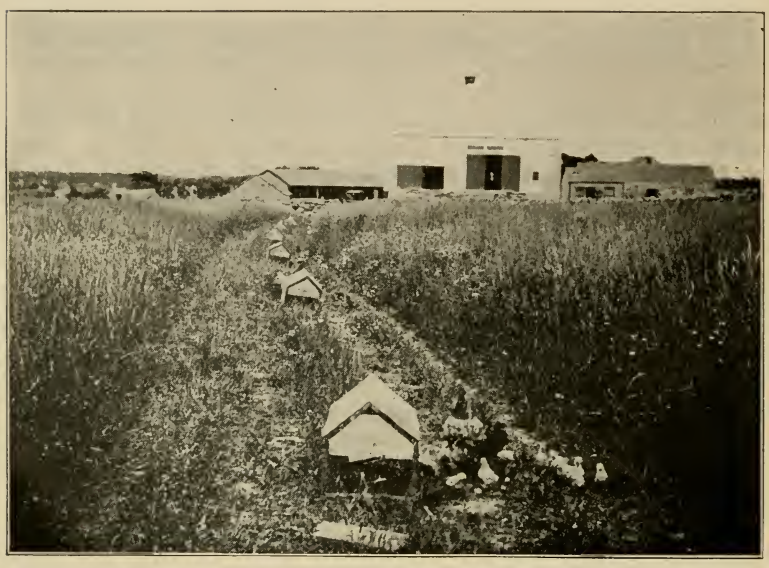
Hard boiled infertile eggs may also be given as supplementary food, simply cutting the boiled egg in halves and leaving it in the brooder for the chicks to pick at shell and all. One egg is sufficient for 25 small chicks.

Be just a little careful in feeding green food. The best form of vegetable food for winter chicks is a daily supply of raw potatoes cut in large chunks, raw apples, beets, or mangels. These they will eat eagerly but they should be given no more daily than they will clean up in a few hours. As they grow older they may be given scalded cut clover, fresh, green cut rye, and any form of fresh, succulent, wholesome green food that may be available. Lettuce should be fed carefully at first, as it sometimes upsets the chicks. Onions should be fed very sparingly. In feeding cabbage never feed any that have been frozen, as frozen vegetables are liable to cause diarrhœa in small chicks. In summer time the ideal way to supply green food is to provide a good grass range on which there is plenty of white and red clover.

By the time the chicks are from one week to ten days old begin substituting for a portion of the chick food, fine sifted cracked corn or corn grits; some clean, best quality wheat screenings, and small-grained, hard red or amber wheat; or gradually substitute the growing food given in this chapter. Gradually work them away from the expensive chick food on to a ration of largely fine-cracked corn, wheat and beef scrap. Waste cereal from the home table is excellent for a variety food, and cooked potatoes will prove an agreeable change from raw ones. When three weeks old they can usually begin to take a part of the regular ration for laying fowls, but the change should not be made abruptly. In making any considerable change in a ration it is usually best to gradually reduce the amount of the old food and increase the proportion of the new a little each day until the change is effected.

Keep the quarters reasonably clean and try to keep the chicks always busy and with keen appetites. Don't allow the chicks to become lousy. No matter how you brood them, make it a point the first day or two to see that the chicks learn to drink and to eat what is good for them. Some very successful growers give each chick, when placed in brood coop or brooder, a little drink of water by dipping its bill. The attention of brooder chicks can be attracted to food by tapping the floor near it with your finger. Don't neglect the chick's education by failing to teach it how and where to warm up and what and how to eat and drink the first day or two. Example and habit has a great influence on whatever mentality the chick possesses, and generally, if they contract bad habits of crowding in places where

they can become chilled or of eating matter foreign to a normal appetite, it is, if the chicks were well born, the result of neglecting early lessons.



An early summer scene in a Rhode Island hay field on a practical poultry plant. Here the chicks and brood hens have tiny houses placed along the roadway leading through the field to the barn, giving an ideal range for the small chicks. The brood hens are tethered by a string fastened to the coop at one end and to the hen's leg at the other. (Photo by Dr. Woods.)

CHAPTER IX.

Growing Chicks

HEN REARED CHICKS should run with the hen until she is ready to wean them. Brooder chicks will be ready to wean when from six to eight weeks old, according to the development of the chicks and the season of the year. Let the comfort of the chicks be your guide at weaning time as at all other times during the chicks' life. If they are well feathered, well developed, and disposed to seek the coolest part of brood coop or brooder for sleeping quarters they are ready to wean.

Sometimes a hen will leave her brood too soon for the season of the year, and in order to make the little chicks comfortable on cool days and cold nights it will be necessary to provide a hover for them in their brood box or to place a jug of hot water, wrapped in flannel, where they can cuddle around it to warm up. A board hover, with felt or cloth tabs beneath, built on legs about six inches high to keep the felt well above the litter, will prove useful for cold weather weaning. Or a burlap bran sack tacked to a wooden frame, a little smaller than the bag so that it will be slack and hang down in the middle, makes a good hover frame to use in brood coops. It can be placed on cleats or made with short legs.

Weaning should be a gradual process. Little chicks need to be kept comfortably warm until well feathered out. Usually chicks that are brooded under hens are weaned gradually. Brooder chicks should, as they approach weaning time, be given less and less heat until they are ready to go without any heat except that supplied by their own bodies. If chicks have been reared in fireless brooders, weaning is easy. If reared in heated brooders they must be gradually "hardened" until they become accustomed to doing without artificial heat.

Chilling at weaning time may mean a serious setback. Faulty care and errors in management—failure to keep the chicks comfortable and well fed—may cause a check in growth or so stunt the chick that it does not recover from it and becomes a source of loss instead of profit.

Chicks should be kept growing all the time; there should be no

standing still periods in which the chick does not appear to grow at all. With a healthy chick development should be continuous and rapid—you should be able to almost "see it grow."

If the weather is cool, do not be in a hurry to move the chicks from brooders or brood boxes. It is easier to keep them comfortable in small brood boxes than in larger coops or colony houses. A good many promising broods have been practically ruined by moving them too soon to colony houses, but use a little judgment in this matter, for you can ruin a flock by keeping it confined too long in small overcrowded quarters.

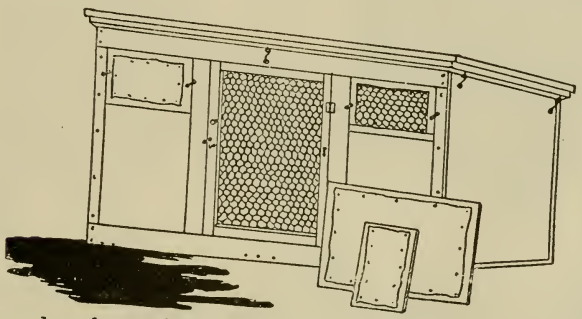
When the chicks are well grown and well feathered, if the weather is sufficiently mild, move them into small colony coops or "A" shaped growing houses. (See illustrations.) Houses of the semi-open or open-front type are best, and they should be so constructed that there will be no floor drafts. Houses with wooden floors, well littered with chaff or cut soft straw, are best for cold weather. Use dry sand on floors in warm weather. Keep such houses reasonably clean.

Weights of Growing Chicks.—No one has yet figured out a dependable weight table that will serve as a standard for normal rapid growth in young chicks in all varieties. Flocks will vary according to season and conditions under which the chicks are kept. Some varieties develop more quickly than others. Under favorable conditions a normal chick when ten days old ought to weigh twice as much as it did when hatched. Usually there is no gain in weight during the first four days of the chick's life, so that at first there may be said to be a period of standing still preparing for the start. After that the growth should be constant. By the time the chick is three weeks old it should have doubled its ten-day-old weight. At two months old it should weigh twice as much as it did at three weeks. It can be made to double in weight again by the time it is four months old, and with heavy varieties you can add about a pound weight each month until the bird is full grown for the variety. Such an increase will admit of reaching a normal, healthy maturity at from seven to ten months old. By confining the birds and feeding a forcing ration you can get much more rapid growth with chicks intended for market and can attain maximum heavy weights in from 22 to 28 weeks from the shell. Illustration in this chapter shows a flock of White Wyandotte chicks intended for breeders, a few of which made the remarkable weights of 2½ and 3 pounds each at ten weeks old. (Photo by author, 1903.)

Colony Coops and Range.—Colony coops located in an orchard or on a well-grassed, well-shaded range make the best homes for growing chicks. They need plenty of fresh air, plenty of sunshine, green grass, clover or newly sprouted grain, and an abundance of good

wholesome food in variety. Growing chicks require large quantities of fresh, raw, succulent green food. It is essential to life, health and good growth. Where they are grown on bare runs they should be supplied daily with plenty of cut grass, clover, oat sprouts, cabbage, raw potatoes or other greens and vegetables.

Shade is important in hot weather. Sufficient sunshine for health is necessary and a very important factor in successful chick growing, but too much hot sun with no suitable shelter to run to is fatal. Orchard trees, berry bushes and shrubbery afford excellent shade. If these are not to be had, shelters of some sort must be provided. Low tents made of burlap, old canvas, awning cloth, or cheap heavy cotton cloth will make good shelters. Board lean-tos will serve. Evergreen trees like spruces and pines afford fine shade, and pine boughs can



Cheap colony house, for growing chicks, 6 ft. wide by 3 ft. deep, 3 ft. high in front and 2 ft. high in back; provided with cotton curtains to cover wire front in stormy weather. This coop can be built at a cost not to exceed $5.

be used to advantage in making chick shelters. Tall growing corn, and even tall weeds, give grateful shelter from the hot summer sun. A field of corn, after it is a few feet high, makes a fine summer range for growing chicks.

Fresh-air quarters are essential to life and health and to good growth. Most of the colony chick coops are provided with partly open fronts; don't use one with a tight front. Shutting chicks up in snug, close, stifling coops often results in heavy losses. Fresh, pure air to breathe is needed even more at night than during the day.

Probably the best small colony house for growing chicks is the partly open-front box coop 6 ft. long, 3 ft. deep, 3 ft. high in front and 2 ft. high in back, having a shed roof, wire front and cotton cloth screens to close in front in stormy weather. Such houses can be had

at various prices up to as high as $14 each, but a New England box factory is manufacturing such houses in quantity for poultrymen at prices that do not exceed $5 for each house.

The Woods open-front house, built on skids and supplied with a wooden floor, makes a good house for growing stock. For a small portable house it can be built as small as 6 ft. wide by 10 ft. deep and 6 ft. high at peak. The Woods house is described in book "Open-Air

White Wyandotte chicks grown for breeding stock. These birds attained weights from 2½ to 3 pounds each at ten weeks old. (Photo by Dr. Woods.)

Poultry Houses," published by American Poultry Journal Publishing Co., Chicago, Ill.

Colony houses with "A" shaped roofs, built with roof starting close to floor, can be cheaply built and make excellent quarters for growing stock. Illustrations show two of these houses.

In housing chicks give them plenty of room. Always provide open-front quarters. Small flocks, as a rule, do best. Don't crowd their sleeping quarters and don't shut them up closely at night. Protect

the house against foxes, skunks and other "varmints" by a good strong fine mesh-wire screen and let the sleeping birds have an abundance of fresh air.

Don't be in a hurry to supply chicks with roosts. When they are about three-fourths grown and begin to look about for roosts will be time enough. Late in summer or early in fall, six weeks or so before you intend to move the birds to winter quarters, they should be pro-

Cheap "A" shaped colony house, fresh-air type, used for growing chicks and for small breeding pens or for flocks of market chickens. (Photo by Dr. Woods.)

vided with roosts so that they will learn to use them by the time you are ready to house them for winter.

Protection from Hawks and Crows.—Where growing chicks have wide range, hawks and crows are often very troublesome, particularly during the breeding season, for these marauding birds. Crows will often hide in pines or spruces near the chick runs, or even in orchard trees, and wait for an opportunity to swoop boldly down on a young chick and carry it off, even when the attendant is in the immediate neighborhood.

Always bury dead chicks or burn them. Burning is best. If you throw them out in some out-of-the-way part of the farm they are sure to be eaten by crows, skunks, dogs, rats and cats, and it gives such prowlers a taste of chicken meat that makes them want more and soon you will have your hands full of trouble.

For protection against crows and some hawks, it is a good plan to erect slender poles about the chicken runs. From these extend, above head heighth, wires or stout cord running zig-zag all over the range, and from the cord or wire hang bits of colored rags, bright

Another type of "A" shaped colony house suitable for growing chicks, half grown and full grown stock. (Photo by Dr. Woods.)

tin, glass or looking glass; hang the latter so that they will jingle in the breeze and glitter in the sun. This makes a very good hawk and crow scare. Sometimes there is no remedy that will work but shooting the pests, and as they usually make their raids at about the same time each day, you can usually get a shot at them. You can trap some hawks by erecting tall poles and placing a small steel trap on top of pole. Be sure to fasten the trap to the pole with wire.

Where cats are troublesome protect the chicks with wire enclosed runs, made cat proof. Often the pampered pet tabby is an incorrigible chicken thief and will steal chicks of any size up to two pounds, and I have known a cat to kill adult fowls. Shoot the thief

when caught in the act if you live in the country on a good sized place. If you have a town or city lot plant, don't take any chances using firearms. Shooting near dwelling houses is risky business, and if there is an ordinance against it you are liable to pay a heavy fine if any person complains of the shooting. Trapping the thieves in a box trap, baited with catnip and placed in the poultry yard, is an easy and quiet way to get rid of cats that prey upon fowls and chickens.

Foxes are very troublesome in some localities, and high fences, one or more good dogs and shooting the foxes are about the only effective remedies. The carcass of a chicken dosed with strychnine placed at night near the runs of foxes may get them but is risky, as valuable dogs may eat it and be killed. Take in the poisoned flesh during the day to avoid poisoning domestic animals.

Skunks you can usually shoot if you go hunting them with a lantern about 10 o'clock in the evening. Steel traps baited with dead chicken are also effective. A few eggs dosed with strychnine placed outside the chicken runs at night and carefully gathered in the morning will prove an easy method of killing off skunks. Be careful with poison and do not leave any poisoned food or eggs about the place except while all stock is safely confined.

Changes in Rations.—Don't make changes in rations abruptly. Go about it gradually. When feeding a chick food gradually reduce the amount of chick food fed and add growing food to take the place of it, a little each day until no chick food is fed. Do the same with any change made in any standard ready-mixed rations. Rule does not apply to regular daily variations in rations or to the feeding of supplementary foods.

Stock Birds and Layers.—For best results in stock birds and layers give the growing chicks liberal range. If the pullets are to be used as layers only, pushed for all there is in them the first laying season and then marketed, they will stand more confinement and pushing when growing up. Chicks intended for breeding stock ought to have plenty of range and conditions as favorable as possible to normal, healthy growth.

It is usually best to wean them from chick food by the time they are three or four weeks old, gradually changing from chick food to other food until they get practically the same ration as the adult breeders or laying stock, when chicks are from ten weeks to three months old. Or you can keep them on a growing food ration until a little more than half grown and then begin to work them on to the regular adult ration so that you have them accustomed to it by the time you are ready to house them. For growing breeders and layers I

like a combination ration of a good dry mash, a good cracked and whole grain mixture, combined with occasional feedings of a moist mash. Green food should be fed freely. They should also have an abundant supply of mineral food (grit, shell, dry bone, etc.) and should be supplied with granulated charcoal and plenty of good water.

Market Chicks.—Early feeding of market chicks should not differ materially from other chicks. They can be grown with less range and fed more heavily on forcing and fattening foods. You want to get rapid growth and soft, tender meat. Such chicks can be fed largely on cracked corn or coarse cornmeal (yellow) trough-fed dry; with beef scrap and bran in hoppers and coarse beef scrap fed with some corn grits in the litter. Give green food freely and let them work for part of their food until you have them within two weeks of marketing age, then keep them more confined, take away the litter, sand the floors, cut out the supply of green food and give them all of the cracked corn and beef scrap that they will clean up without "going off their feed." If birds are large enough to feed on whole corn and will eat it more readily, give it to them in place of cracked corn.

A good dry mash mixture for pushing market chicks before they get corn and scrap exclusively is the following:

Mixed feed	1 measure
Coarse cornmeal	2 measures
Stock food	1 measure
Best beef scrap	1 measure
Alfalfa meal	½ measure

"Mixed feed" is about equal parts of wheat bran and middlings. "Stock food" is corn, oats and barley ground into a coarse meal and mixed with the by-products of these grains. As the chicks develop and approach marketable age gradually reduce other ingredients until you are feeding mainly cornmeal and beef scrap.

Housing Stock Birds.—When the time comes in the fall to bring in the stock birds from summer range to the winter yards and houses, be prepared to make the change one that will prove the least possible interference with the habits and comfort of the flocks. Use open-front houses. Don't crowd them. Provide sufficiently low roosts. See that the birds use the roosts at night. If birds are to be confined to the house through the winter, don't start them that way when direct from the ranges. Make the change a gradual one, if possible. Provide yards, temporary ones if necessary, and have plenty of green stuff growing in these yards. When the green stuff in yards runs low, supply plenty of other green food and raw vegetables daily.

A good deal of unnecessary trouble is started each fall by making

an abrupt change from open coops on liberal range, with an abundance of green food, to closed houses, small bare yards, crowded quarters and a complete change in ration. Make all necessary changes in such a manner that the birds will get accustomed to it with the least discomfort and make as few changes as possible.

Plymouth Rock and Brahma capons and dressed capons. Specimens of quick grown market chickens from vigorous stock. The kind that are in demand in the best markets and bring 40 to 50 cents per pound dressed at 22 to 28 weeks old. (Photo by Dr. Woods.)

Well grassed range and small colony coops used for growing chicks on a practical egg farm in Little Compton district, Rhode Island. (Photo by Dr. Woods.)

CHAPTER X.

Facts About White Diarrhoea

CHICK MORTALITY in recent years has reached most alarming proportions. During the past fifteen years the losses of small chickens between the ages of three days and two weeks have amounted to millions of chicks annually. Some proprietors of practical poultry plants which I have visited during this period have acknowledged to me a loss of from sixty to ninety per cent in many broods from a disease which they termed "white diarrhœa." So general has this loss of chickens become, increasing yearly, that experiment stations all over the country are giving a great deal of the time of their best men to a study of the subject in an endeavor to learn the cause and cure.

After careful study, investigation and experiments, I have found remedies which can be depended upon to prevent and cure many cases of the infantile disorders of small chicks that are commonly classed under the name "white diarrhœa." These remedies have been thoroughly tried and tested and can be relied upon to prove safe, sure and effective. Where my methods of managing the breeding stock, handling the eggs before and during incubation, management of incubators, care of chicks and brooding equipment are employed, the mortality of small chicks can be reduced to the minimum. If due care is exercised in following the directions found in this book the death rate in small chickens at any season of the year need not exceed five to ten per cent. Many broods have been reared without the loss of a single chick. The remedy, formula for which is given in this chapter, can be relied upon in the majority of cases to prevent disease, repair lost vitality and cure so-called white diarrhœa, provided the chicks are not already too far gone when the remedy is applied. No absurdly extravagant claims are made for the remedy prescribed for your chicks. There is no such thing in legitimate and practical medicine as a real "cure-all." The much advertised poultry remedy for which extravagant claims of cures are made and which is backed by an apparently absolute, cleverly-written guaranty to "cure in every case

or your money back" can often be safely set down as a cheap humbug, seldom safe to use and sometimes positively dangerous. You might find it difficult and expensive to get your money back if you wished to test the validity of the guaranty.

You can absolutely depend upon this remedy to do all that any carefully prescribed and properly used remedy can do in curing disease, more than that I or anyone else cannot honestly claim for any medicinal preparation. For over four years the white diarrhœa remedy of combined tissue phosphates, formula for which is given in latter part of this chapter, was sold to and used by hundreds of poultrymen in all parts of the United States, Canada, and a number of foreign countries. Every report received was a testimonial to the successful use of the remedy in treatment of the diarrhœal diseases of young chickens. Many poultrymen ordered the remedy in large quantities and were so pleased with the results that they duplicated their orders several times. As a commercial proposition the remedy cost too much to prepare and deliver and the price had been made low in order to have it well tried out as widely as possible. The poultryman can have it prepared at any homœopathic manufacturing pharmacy at lower cost than I could afford to produce it and keep it on the market, as the preparation calls for thorough machine trituration. In giving the remedy to the public in this book I am following the course originally intended and one that I have followed with many of the most valuable formulae used by poultrymen.

White Diarrhœa.—It is unfortunate that the name "white diarrhœa" should have been so generally and commonly used to describe practically all ailments which result in a high death rate in small chickens. The actual diarrhœa or discharge of a lime-like excrement mixed with glairy mucus is of itself only a symptom. This condition may occur in a considerable variety of diseases of young chicks. Where this symptom of "voiding whitewash," as it has been aptly termed, is not present the chicks frequently "paste up behind," or die off with little or no apparent warning and no evidence of bowel trouble.

All fatal diarrhœas of young chicks are not necessarily bacillary white diarrhœa, which apparently is a specific disease for which Dr. Leo F. Rettger, of Yale, believes he has found the specific germ, a microscopic organism which he names bacterium pullorum. Other observers have isolated other organisms which they believe to be the specific germ of white diarrhœa, but Dr. Rettger's experiments have apparently been the most thorough and painstaking and his conclusions agree more closely with the facts of general experience among poultrymen than laboratory results reported by other scientists

to date. Therefore, I am disposed to believe that epidemic fatal white diarrhœa is usually "bacillary white diarrhœa" caused by **bacterium pullorum** (Rettger).

It is probable that there are other diarrhœas of young chicks due to other germs not yet identified. "White diarrhœa" of itself is only one symptom of disease and might appear, undoubtedly does appear, in more than one fatal disease of chicks.

Causes of White Diarrhœa.—In investigating the causes of so-called white diarrhœa there are four general sources and one specific source of trouble that demand your attention:

FIRST.—The condition of the breeding stock from which the eggs for hatching were taken.

SECOND.—Carelessness in selection, handling, keeping and care of eggs intended for hatching purposes.

THIRD.—Faulty incubation.

FOURTH.—Errors in brooding and feeding.

FIFTH.—A specific germ—bacterium pullorum.

Before taking up the symptoms it will be well to review a few of the various names which have been applied to diseases which come under the general classification "white diarrhœa." These have in a general way included all losses from so-termed "non-absorption of the yolk," enlarged caeca, "pasting up behind," "spraddles," "wabbly legs," "wasting disease," "appendicitis," acute indigestion, congenital anaemia, rachitis, marasmus, and a great variety of other descriptive terms.

Loss or lack of vitality more fitly describes the condition which we find causing a high death rate in chicks under two weeks old. In some cases the chicks die of disease which finds them favorable victims, owing to their low vitality. In other cases the chicks actually die of exhaustion because they did not bring into the world with them a sufficient amount of that vital force which enables them to live and thrive. When it is said that a chick possesses vitality it means that the chick has brought into the world within itself that wonderful vital force, the power or capability to live. Vitality means containing a form of energy known as vital force, and this is necessary to supporting life or rendering the chick capable of living. Without a sufficient supply of this wonderful natural force, the chick is a weakling. Upon the degree of vital force possessed by the chick depends its ability to live and thrive and to resist disease. Anything which tends to lessen or decrease the vitality endangers the life of the chick. These matters are taken up in more detail in their proper place under the separate headings which follow and in special chapters of this book.

Symptoms of "White Diarrhœa."—In some cases there may be

entire absence of visible symptoms except such as would appeal to the veteran poultryman who instinctively knows certain chicks for weaklings the moment they are taken from the incubator. The chicks may apparently do well for several days and then die off suddenly without warning, usually being found dead under the hovers in the brooders the first thing in the morning. These weakling chicks almost always possess certain peculiarities not common to a healthy specimen. The weakling is almost always big-bellied, the abdomen protruding to the rear so that it bunches out behind well out of line of the vent, with the result that the chick looks as if the tail piece and backbone had been pushed forward and in just above the vent. As the chick grows older these conditions become more exaggerated and it is wabbly on its legs. Sometimes the deformity is so considerable that when the chick voids excrement it seems almost impossible to eject it over the protruding abdomen without having it come in contact with and soil the down. In many cases the chick cannot force the droppings beyond the fluff or down on the abdomen and the excretion dries on until the little bird is in the condition commonly known as "pasted up behind." At this time the upper margin of the vent usually protrudes to a considerable extent beyond the lower margin and sometimes takes on a red and inflamed appearance. Frequently, but not always, the discharge from the bowels assumes a lime-like or whitewash-like character mixed with glairy, sticky mucus. It was this symptom that resulted in the name "white diarrhœa."

The chicks are dopy, sleepy, droopy and inclined to huddle. As the disease progresses they find it almost impossible to keep warm no matter how hot you have the brooder. Frequently they utter a pitiful chirp or cry and sometimes make shrill cries of pain when passing droppings. In most cases there is no fever, the chick's body and legs feeling cold to the touch. The little birds do not fill out but remain very thin and emaciated. There is wasting of all the tissues. The little birds either die suddenly without warning or gradually waste away and are found dead and trampled flat under the hovers.

On opening the chicks after death the yolk remnant will usually be found to be unabsorbed. Frequently it looks as if it were in a putrid or semi-putrid condition, having a mixed greenish and yellowish color. In other cases it may be partly solidified. In still others the yolk may be very watery, of considerable size and of a dark greenish, grayish or blackish color. Sometimes the duct from yolk sack to intestines will be found plugged or solidified and at other times atrophied. Usually there is little or no food in the intestines, though often the crop gizzard will be found packed full of millet, sand or grit. The caecae or blind guts frequently will be found to contain a

considerable amount of brownish or blackish fluid. In some cases they will be almost entirely filled with a grayish or yellowish cheesy accumulation. Some specimens that I have examined have shown the intestines to be packed or clogged with coarse wheat bran.

In almost all cases the ureters, or ducts from the kidneys which empty into the lower portion of the bowel near the vent, will be found to be packed full of white lime-like substance, and this may even extend into the kidney tissue. The chalky or lime-like material which appears in the droppings and gives the name "white diarrhœa" evidently is in greater part excreted through the kidneys.

The whole body of the chick shows evidence of anæmia or a lack of red blood, and of mal-nutrition. It is apparent that the greater portion of the food that has been consumed by this diseased little bird has been wasted and that its body has made use of only an exceedingly small portion. Some few cases show evidence of violent inflammation of the intestines, while in others there is apparently no inflammation whatever present.

The lungs, liver, heart, intestines and sometimes the muscle tissue are frequently found to be full of small nodules or deposits of whitish, cheesy or soft chalk-like substance. These deposits have frequently been described as tubercles, but to date we do not know of anyone who has found tubercle bacilli in the deposits, so that while the possibility remains that some of them are tubercles I am not prepared to say at this writing that any disease known as "white diarrhœa" is actually tuberculosis. In some cases undoubtedly the chicks may be and are tubercular, but there is no direct evidence at the present time to indicate that any cases of white diarrhœa are in reality of a tuberculous character. There is good reason to believe that in many instances the disease is the direct result of infection with a specific germ. This germ may be from excrement of sick or debilitated old fowls and so smeared on the eggs or may come from a diseased ovary.

Symptoms of "Bacillary White Diarrhœa."—Bacillary white diarrhœa is the name given by Dr. Rettger to the specific disease which he has investigated under the general name "so-called white diarrhœa." That this is the common contagious and epidemic form there seems no reason for doubt. That there may be other chick diseases accompanied by the symptom white diarrhœa there is every reason to believe. That other investigators may be right in their conclusions concerning other germs and other contagious forms of white diarrhœa is quite probable. The discussion of the identity of various minute micro-organisms which may or may not cause a disease

always, for some reason, reminds us of the old saying, "Who shall decide when doctors disagree?"

When all is said and the last word spoken, microscopic disease germs are everywhere about us, regardless of their precise identification, and as a general rule they only attack peculiarly susceptible victims—victims that are born predisposed to disease or have lost vitality through some cause and so become vulnerable. If this was not true the vast army of germs would have killed us all off long ere this.

Herewith follow the symptoms and post-morten appearances of bacillary white diarrhœa, as observed by Prof. Stoneburn and Dr. Rettger:

"As in many other diseases, the symptoms may vary within certain limits in the individuals affected. We do not wish to be understood that all of the following symptoms will be observed in every chick suffering from bacillary white diarrhœa; but almost all of them will be apparent in epidemics of any considerable size.

"The earliest deaths may occur within a very short time after hatching, without any prominent symptoms, excepting, perhaps, weakness and lack of vitality. The characteristic whitish discharge from the vent soon makes its appearance in the flock, the time depending, without doubt, upon the virulence of the organism and the mode of infection. The discharge may be slight or profuse, in color white or creamy, sometimes mixed with brown. The voided matter has a more or less sticky or glairy character. It may simply streak down below the vent or may cling to the down in sufficient quantity to seal up the vent. This condition is what poultrymen designate as "pasting up behind." This latter condition, however, is not necessarily indicative of white diarrhœa.

"The chicks soon become listless and sleepy, inclined to huddle together and remain under the hover much of the time. They seem to lose appetite and do not eat much. Frequently when they attempt to take food their action is more or less mechanical. The wings begin to droop or project slightly from the body, with feathers ruffled. In acute cases the eyes are closed and the chicks become indifferent to everything that goes on about them. Many of the chicks peep or chirp constantly, the sound being shrill or weak, according to the strength of the individual. Frequently, when endeavoring to void the excreta, the chicks utter a shrill twitter, apparently a cry of pain. The breathing may be labored, the abdomen heaving with each breath. Occasionally one may note a certain amount of gasping or gaping.

"During the progress of the disease the chick may die suddenly while still fairly strong. When the disease is prolonged the chicks gradually waste away, becoming weaker and weaker until they are

scarcely able to support their own weight. In this stage they will often be seen to rest against foreign objects for support, standing with legs braced apart, squatting, or lying utterly helpless.

"Frequently the chicks take on the appearance which poultrymen call 'short-backed.' The back seems to shorten and the abdomen to protrude out of proportion, causing the chick to look 'stilty' as compared with one of normal development. This condition Woods accurately describes as follows:

'The weakling is almost always big-bellied, the abdomen protruding to the rear so that it bunches out behind, well out of line with the vent, with the result that the chick looks as if the tail-piece and backbone had been pushed forward and in just above the vent.'

"With few exceptions, the deaths from typical bacillary white diarrhœa occur while the chicks are under one month of age. After this a few straggling deaths may be expected, and if complications set in, a high mortality may be observed. The chicks which have had bacillary white diarrhœa seem to be greatly weakened in constitution, and fall an easy prey to disorders which would be resisted by normal chicks.

"Those which survive remain more or less stunted in their development. Frequently they are misshapen, with long beaks and 'crow heads,' and with imperfect feathering. In every way they impress one as being weak and lacking in vitality. This condition may persist indefinitely, or the bird may slowly regain vigor and vitality and make fairly satisfactory development.

"The usual method of autopsy has been followed here, the bird being placed on its back on a board, the outstretched wings and legs tacked in position, the skin covering the breast and abdomen removed and the internal organs exposed to view by removal of the entire breast bone. In typical cases the following conditions are found:

"CROP—Empty or partially filled with slimy fluid or food.

"LUNGS—Apparently normal. (Tubercles not observed.)

"LIVER—Pale, with streaks and patches of red. The congested areas are usually large in size. Occasionally epidemics will be met with in which the liver is more or less congested throughout. In such cases the portion of the stomach lying in contact with the liver is inflamed.

"KIDNEYS and SPLEEN—Apparently normal.

"INTESTINES—Pale, and for the greater part empty. A small amount of dark grayish or brownish matter frequently present.

"CECA—With few exceptions, but partly filled with a grayish soft material. Only occasionally cheesy or firm contents.

"UNABSORBED YOLK—Usually present, varying in size from a

pea to a full sized yolk. The color may vary from yellow to brownish green or nearly black. In consistency there is also much variation. It may appear perfectly normal, distinctly gelatinous, or watery. Frequently it looks like custard and again it is more or less dry and firm. Unless the chick has been dead for some time the yolk is not putrid, but merely stale.

"The chick, as a whole, appears more or less anaemic and emaciated. The muscles of the wings, breast and legs may be almost completely wasted away."

Infection.—If this disease is due to only one specific micro-organism or if "white diarrhœa" is a symptom of several germ diseases, it is, of course, infectious. In my experience and observation, if contagion or infection (please take both words in their broad meaning) takes place at all, it only occurs in susceptible individuals at a very early period. Healthy chicks have frequently been allowed to run with those affected with white diarrhœa and have not contracted the disease. On one poultry plant where I had this trouble under observation several flocks of white diarrhœa chicks were placed in a brooder house without spreading the disease to the remainder of the birds housed therein. Chicks from the well flocks ran in and out of the white diarrhœa pens and suffered no inconvenience or ill effects.

Apparently contagion takes place, if it does at all, between the time when the chick first pips the shell and the completion of the drying off period. Marked chicks were placed in machines which were believed to contain infected eggs and chicks. These little birds were introduced to the incubators just at hatching time. If taken from another incubator or from hens' nests just before or as soon as they were nearly dry and placed in these infected incubators, they invariably contracted white diarrhœa when the flocks hatched in the machines developed the disease. Healthy chicks two to four days old when placed in the same machines under the same conditions did not contract the disease. Chicks, from eggs hatched in white diarrhœa machines, placed under hens developed the disease in the same time and manner as the brooder flocks. Marked, healthy hen-hatched and incubator-hatched chicks from fumigated incubators placed in brooders with white diarrhœa chicks and under hens having diseased chicks in the flock did not contract the trouble and lived and thrived well. This, I believe, supports the statement that the disease, if contagious, is contracted very early in the life of the chick, at least sometime before it is 48 to 72 hours old, also that it attacks only susceptible individuals.

By careful experiment it was found possible to hatch a flock free from white diarrhœa in a given incubator, the preceding lot of chicks

from which had suffered heavy losses from the disease. Following this up it was possible to again practically at will obtain lots of chicks that would develop the disease or not at the desire of the operator, proving almost conclusively that it is possible, even with eggs from doubtful sources, to control some forms of white diarrhœa, and with selected eggs from selected healthy breeders to prevent the occurrence of the disease altogether.

On the subject of infection with bacillary white diarrhœa, Dr. Rettger and Prof. Stoneburn say:

"The mother hen is the original source of infection, the specific organism being present in the ovary. Consequently the organism is to be found in the yolks of a certain proportion of the eggs produced by infected hens, and chicks from such eggs have the disease when hatched.

"In numerous tests it was demonstrated that chicks could be infected with bacterium pullorum through infected food. Normal chicks may contract the disease through food or water contaminated with infected droppings. Infection through the food supply takes place at an early age, in all probability within the first three or four days after hatching. Infection from chick to chick cannot, apparently, take place after they are three or four days old.

"Eggs from infected hens contain the organism in the yolks.

"As a rule, infected chicks make less satisfactory growth than those that are apparently normal. For some time they appear stunted and weak, but may eventually undergo more or less complete development.

"The female chicks which survive often harbor the infection and may become bacillus carriers. Infection in the breeding pens may be perpetuated in this manner.

"In all probability infection does not pass from adult to adult.

"Infected hens are apparently poor layers, especially in their second and subsequent laying seasons. Apparently such hens lay regularly only in the spring and summer, the natural breeding season. Chicks hatched in the late fall, winter or early spring are comparatively free from this disease.

"It is of the greatest importance that the poultryman learn to recognize bacillary white diarrhœa, both through external symptoms and post-mortem appearances of diseased chicks. The mere discharge of whitish material from the vent is not in itself proof that the chicks are affected with this specific disorder.

"Infected hens should be eliminated from the breeding pens. Such elimination is made possible by pedigree records of chicks. If the eggs from the different pens are hatched separately, and the

chicks segregated for the first few days, it will soon be made apparent through the condition of the chicks, which pens contain infected hens. This may prove effectual in cases where infection has not become general. To determine which individual hens are infected, the trap nest should be used, and the same general procedure followed.

"In case infection exists and it is not practicable to determine the breeders which are infected, the entire flock should be discarded for breeding purposes, and eggs for hatching secured from a non-infected farm. We have records of farms where the disease has been eliminated in a single season by following this plan, and without any change in equipment or methods.

"Another possible means of determining infection of breeding hens is the direct examination of the ovaries. It is entirely practicable to inspect these organs through an opening in the side of the bird similar to that made in caponizing. Where the abnormal condition is marked it may be easily detected.

"Great care should be exercised that breeding stock, young chicks or eggs for hatching be secured from flocks which are free from white diarrhœal infection.

"As to the means of preventing the spread of infection from chick to chick, segregation of chicks during first four days after hatching should prove effective. It is entirely probable that keeping chicks in small groups in the incubator for forty-eight hours after hatching will materially reduce the chances of a few infected individuals spreading the infection through the entire hatch. For division into small groups we suggest the use of pedigree trays, wire baskets, or bags made of mosquito netting. Naturally, the smaller the group the less chance of spreading the infection.

"From the time the chicks begin to hatch until they are removed to the brooder, the incubator should be kept dark. This will largely prevent the chicks from picking at the droppings.

"Since infected chicks make unsatisfactory development for the first few weeks, and may later regain vigor and make fair growth, it is advisable to select at an early age those intended for breeding purposes. The selection may be made when the chickens are from eight to ten weeks of age, reserving only those which show greatest vigor and development.

"Incubators, brooders and all other appliances used in the hatching and rearing of the chicks should be cleaned and disinfected frequently.

"Food and water should be supplied in such a manner as to prevent contamination with infected droppings. The use of fine

absorptive litter in the brooder, especially the first few days, is also advisable.

"The feeding of sour milk may prove very effective as a preventive measure. The milk must be fed early or during the infection stage. After the white diarrhœa organism has once entered the general circulation, such treatment is of little or no value. Hence, sour milk should not be looked upon as a cure, but merely as a possible preventive agent.

"Since perfect physical condition is, as a rule, a barrier to disease, it is important that the health and vigor of the breeding stock and chicks be raised and constantly preserved. Proper methods of housing, feeding, incubation, brooding and management should therefore be employed."

In comment on the foregoing by Dr. Rettger and Prof. Stoneburn I wish to add:

It is important to note that not all eggs laid by infected hens were found to contain the bacterium pullorum; this may explain why some chicks from a certain hen mother apparently escape infection. Query: Might not such chicks possess diseased ovaries, be susceptible to infection and prove a source of trouble if pullets?

Apparently Messrs. Rettger and Stoneburn have not found, and do not credit the presence of, the infectious matter ON the outside of the eggshell. This may be true of the bacterium pullorum, but other investigators name other micro-organisms as the probable cause of disease symptoms which are apparently almost identical with so-called white diarrhœa, except for some post-mortem difference that would only be noted by a trained observer. I have produced similar disease in chicks by smearing droppings of infected hens on eggs used for hatching. I have had numerous cases reported where the disease was prevented, on plants where it had previously been a scourge, by simple disinfection of the eggs used for hatching—dipping them just before setting in a solution of one gill of creolin in eight and one-half quarts of soft water. In these cases had the germs been IN the eggs the dipping would not have yielded such good results. We should not lose sight of the fact that it is entirely possible that more than one group of microscopic germs may be capable of producing in young chicks disease symptoms which we know as "white diarrhœa." In case of doubt it is well to observe all of the reasonable precautionary measures that we know of for the prevention of the disease.

It has been demonstrated that chicks may have white diarrhœa and live, even develop into specimens that a careless observer, and perhaps a trained one, might pass as a normal fowl. Such birds, if

females, would have infected ovaries and be capable of sowing the disease broadcast. It follows that chicks reared in a white diarrhœa flock SHOULD NOT BE BRED.

It is stated that in all probability infection does not pass from adult to adult. Here we tread on dangerous ground. It is not safe to assume that any disease which may be transmitted in contaminated food and drinking water will not pass from adult to adult fowl. It is quite possible that adult fowls may not present any symptoms of the disease, their ovaries or testes may remain uninfected, but what is to prevent the bacilli, taken into the digestive tract in infected food or drink, from multiplying in the intestinal tract and disseminating the disease through the droppings or through smears on the egg shells? "Poisoned" or tainted ground is a common source of disease in young chickens and old fowl and it is a fact, that cannot be successfully contradicted, that ground is tainted or "poisoned" by droppings laden with micro-organisms, not only from diseased fowls, but from apparently healthy birds, whose only association with the disease appears to be that of a carrier of the germs.

If it should prove true that infected hens are invariably poor layers, especially in second and subsequent laying seasons, and that apparently such hens lay only in spring and summer or the natural breeding season, then it should not be difficult to select breeding stock comparatively free from taint by choosing late fall, winter and early spring chicks to grow for breeding stock.

Make HEALTH, VIGOR and VITALITY your slogan always in all poultry keeping. Breed for health, grow, feed, house and manage for health first, last and all the time. It is only by having healthy fowls with sound constitutional vigor and by doing your best to keep them sound and healthy that you can hope for immunity from disease.

Before taking up the treatment of white diarrhœa (so-called) I wish to emphasize the more important methods of prevention. Bear in mind the old and wise saying, "An ounce of prevention is worth many pounds of cure."

Selection, Care and Management of the Breeding Stock.—Be sure to always consider the condition of the breeding stock. Losses of small chicks may result from breeding immature (not full grown or developed) males or females, or from fat, old birds that are out of condition, from fowls that have been overforced for egg production, that are or have been diseased, that are kept in crowded, unsanitary quarters, or are out of breeding condition from any other cause. Please read Chapter I to IV inclusive on selection, feeding, care and management of breeding stock. You cannot be too particular to have your foundation stock right.

It has been demonstrated in the case of bacillary white diarrhœa that the mother hen is a source of infection. The breeding stock may be both a direct and an indirect source of infection. Breeding from unsound breeders would be an indirect cause of the disease by producing low vitality chicks that are predisposed to disease from the day they are hatched. You cannot make any mistake if you will consistently and persistently BREED FOR HEALTH.

Selection and Care of Eggs for Hatching.—Do not forget that the cause of white diarrhœa, the germ or organism which causes the disease, may be found either in or on the eggs, and that **carelessness in selection, handling, keeping and care of eggs intended for hatching purposes** is a very common cause of mortality in young chicks. Unfortunately the majority of poultry keepers fail to appreciate this fact. Provide three or four comfortable nests to each 20 to 25 birds so that the fowls will not be inclined to crowd on the nest and soil or crack the eggs. Test the eggs from each pen occasionally to see how they are running in fertility. If the percentage of fertility is not good, try a change of male birds or reduce the number of females allotted to one male. In Chapter V you will find detailed information concerning eggs for hatching. It does not pay to take any chances with poor eggs or eggs that have been mishandled.

Faulty Incubation.—You will find the subject of successful incubation, natural and artificial, treated in Chapter VI. **Faulty incubation** is a common cause of chick mortality. The use of poorly constructed incubators, careless management of all incubators or of sitting hens often results in a waste of vitality of the embryo chick, with the result that the little birds when hatched die off quickly from supposedly mysterious causes, and are so charged up against white diarrhœa.

Errors in Brooding and Feeding.—Chapters VII to IX, inclusive, tell how to brood and feed chicks, and I believe will help you. Errors in brooding or feeding sometimes result in chick mortality or losses from so-called white diarrhœa. The best means of prevention is to use wholesome food and to properly brood and care for the flocks.

The Specific Germ.—Bacterium pullorum has been named in this chapter as the cause of bacillary white diarrhœa, an infectious disease. The germ is not likely to make a successful attack on a normal, well-born, healthy chick that is full of vigor and vitality. The only satisfactory way to get rid of this disease is to breed only healthy fowls. By trap-nests, or otherwise, cull out any infected adult birds, kill and burn them. Don't use eggs for hatching from infected flocks. Avoid or clean up and disinfect infected ground. Breed for health.

Formula for Successful White Diarrhoea Remedy.—This remedy

was tried in private experiments in 1906 and 1907 and was so successful that it was decided to put it on the market for a time and endeavor to secure unbiased testimonials from persons who paid for the remedy because they needed it and would therefore use it. I now have had the remedy on the market for four years and have a big bunch of testimonials from satisfied users in both hemispheres.

It has been shown in experiments and laboratory tests that ill-born chicks, some incubator chicks and particularly white diarrhœa chicks are lacking in the normal mineral content of healthy, vigorous chicks.

Biochemistry suggested that as white diarrhœa chicks and weakling chicks are lacking the normal proportion of mineral matter in their tissues, there must be a deficiency of "cell-salts" which compose the tissues involved. If the missing factors (mineral salts) could be supplied in easily assimilable form, then reaction would follow and equality, harmony and health would be established.

It is not necessary to be over-fussy in preparation of tissue remedy combinations for young chicks, therefore twelve remedies were combined in a one-grain tablet triturate. Any reliable homœopathic pharmacy can prepare these tablets for you at moderate cost. Preparation without proper machinery is too expensive to warrant my keeping them on the market, and hereafter I must decline to fill any orders. The ingredients should be triturated to the finest possible powder and made into tablets with the addition of calcium carbonate. The formula follows:

Calcium fluorid	1/1000 of a grain
Calcium phosphate	1/100 of a grain
Calcium sulphate	1/100 of a grain
Ferrum phosphate	1/100 of a grain
Potassium chlorid	1/100 of a grain
Potassium phosphate	1/100 of a grain
Potassium sulphate	1/100 of a grain
Magnesium phosphate	1/100 of a grain
Sodium chlorid	1/100 of a grain
Sodium phosphate	1/100 of a grain
Sodium sulphate	1/100 of a grain
Silica	1/1000 of a grain

Above is composition of one tablet.

Treatment of White Diarrhœa.—The preventive treatment of white diarrhœa begins with the breeding stock and follows through the care of eggs for hatching, incubation and brooding, and management of the chicks. This has been fairly well covered in the preceding chapters. The first rule in treating any disease is to seek out

and remove the cause. I have tried to make clear that anything that tends to lower the vitality of the breeding stock, of the germ or embryo within the egg, or of the chicks after they are hatched, may result in so-called white diarrhœa or wasting disease.

By breeding and striving for vitality through common-sense management of the flock, the poultryman exercises the best means of prevention of all diseases.

Even when little chicks are born with a comparatively low vitality, they can by careful and painstaking management be encouraged to acquire vitality and stamina during their growing up, provided they are not seriously handicapped by too great a loss of vitality at the start.

As a preventive measure other than those previously recommended, the remedy in tablet form, formula for which is given in this chapter, for white diarrhœa chicks is a very effective one. This tissue remedy, when properly used, can be relied upon to assist in the restoration of lowered vitality, correct wasting disease, restore disordered digestive organs to their normal functions, help the chick acquire vitality and an abundant supply of good red blood.

As a preventive measure, dissolve twelve tablets in one pint of drinking water and allow the little birds no other drink. Renew the remedy and the drinking water daily for one week. Thereafter it need not be given oftener than twice a week if the chicks are in fairly good condition. The same method of treatment will prove effective in mild cases.

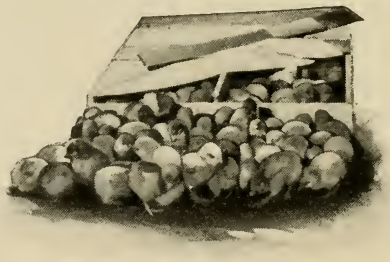
In severe cases of white diarrhœa where losses have been considerable, cull the flock very carefully and kill off any specimens that seem very far gone. It is waste of time to attempt treatment of little chicks that are too sick to eat and drink. Little birds that persist in crowding under the hover and will not come out for food cannot be benefited by any remedy.

Chicks that will eat, though seriously sick, may often be cured. Withhold all grain food for a period of two or three days and give several times a day the remedy prepared in the following manner: Thoroughly scald or bring to the boiling point good, sweet, whole milk; add to this a sufficient amount of thoroughly boiled white bread flour to give the milk the consistency of medium heavy cream. Do not get it too thick for the chicks to drink readily. In one cupful of this prepared milk dissolve ten tablets of the remedy, which have been crushed before adding to the milk. Also add a very small pinch of grated nutmeg and one-quarter of a level teaspoon of pure powdered ginger. Of the above preparation allow the little chicks all they will drink from three to six times daily. Do not leave this milk

mixture before the chicks all the time, as they are liable to get themselves messed up in it and so become wet and chilled. Usually in two to three days the little chicks will be ready to return gradually to the regular ration, but continue giving an occasional feeding daily of the remedy prepared in milk, as directed. Discontinue the remedy only when you are sure that the chicks are well out of danger.

When the little chicks paste up behind remove the accumulation of dung and bathe the parts with creolin and warm water. Do this as often as you find droppings caking on about and below the vent. For this purpose use one-half teaspoonful of creolin in a pint of comfortably warm water. Dry the chick before you return it to the brood.

When returning them to the dry food ration it may be supplemented with thoroughly dried stale bread crumbs that have been barely moistened with warm, sweet milk, also with mashed boiled potatoes, boiled cracked rice, boiled wheat and a very little raw potato. Be sure to keep the chicks warm while under treatment.



They will require a rather higher breeding temperature than healthy chicks of the same age, and should not be given too much freedom. Keep them confined close to the brooder or inside of it according to age.

Chicks that have been seriously ill with white diarrhœa should not be kept for breeding stock. If they make a good recovery, grow them as quickly as possible to broiler or roaster sizes and sell them off as market poultry.

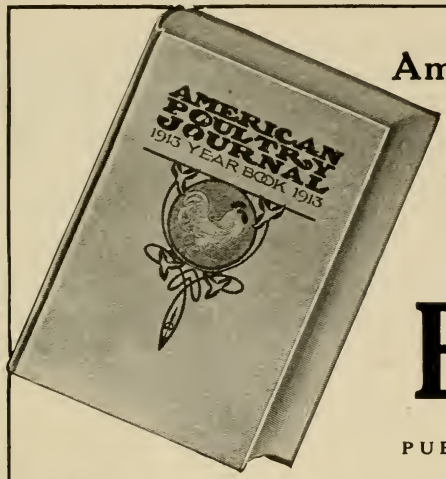
Where soil is not infected chicks that do not thrive well are sometimes benefited by feeding them all they will eat of angle worms and chopped dandelion leaves until it physics them.

Where white diarrhœa is suspected the following is worth a trial and has worked well in a number of cases as an intestinal disin-

fectant. When the chicks are removed from the nest or machine give each chick a little drink of medicated water by dipping its bill. Use a solution of three drops of creolin in four fluid ounces of boiled water, which has been allowed to cool before mixing. Mix freshly each time needed.

Don't get worried because you have had white diarrhœa in your flocks or because you have had troubles that indicate poisoning of the soil. Make up your mind to fight the trouble. Find the cause and get rid of it. Top dress your land with air-slaked lime, plow it in and grow a good crop on the land to sweeten it; repeat this often. Get rid of all diseased stock. Make up your mind to breed only from HEALTHY BREEDING BIRDS, full of VIGOR and VITALITY, and if you stick to it with sufficient common sense, push and pluck YOU ARE SURE TO SUCCEED.

(The End.)



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